SPECIAL ENVIRONMENTS OPERATIONS (DESERT)

Subcourse Number IN0828

EDITION B

United States Army Infantry School
Fort Benning, Georgia 31905-5593

5 Credit Hours

Edition Date: June 1992

SUBCOURSE OVERVIEW

This subcourse is designed to teach you to survive, operate and conduct warfare in special environments. You will identify and select the characteristics of the Desert in accordance with the key word METT (Mission, Enemy, Terrain, and Time). You will identify and plan for special considerations in the prevention, identification and treatment of hot and cold weather injuries in the desert. You will identify the effects of changes within the environment to include battlefield light, noise and range estimation. You will determine and select methods, techniques and procedures used in camouflaging self and equipment in a desert environment to include protection of eyes and skin from overexposure during extreme heat, protection from the sun during daylight hours, and how to construct a field expedient shelter in the desert. You will be able to demonstrate supervisory skills in directing and supervising weapons maintenance in a desert environment and identify and select the desert's environmental effects on personnel and equipment. You will be able to determine and select factors and considerations for preparation of desert operations and explain how the desert environment affects deception operations. You will be able to plan for and explain the methods of employment when conducting operations against the enemy in desert operations. You will identify and select the fundamentals, considerations, and methods of attacks used in offensive operations in a desert environment. You will select fundamentals and environmental considerations used in defensive operations in a desert environment.

There are no prerequisites for this subcourse.

This subcourse reflects the doctrine which was current at the time it was prepared. In your own work situation, always refer to the latest publications.

The words "he", "him", "his", and "men", when used in this publication, represent both the masculine and feminine genders unless otherwise stated.

TERMINAL LEARNING OBJECTIVE

TASK:	You will identify the procedures used to survive, operate and conduct warfare in a desert environment.
CONDITIONS:	You will have information from FM 90-3, FM 21-76 and Newsletter No. 90-7, Special Edition, Aug 90.
STANDARDS:	You will identify and perform the procedures used to survive, operate, and

conduct warfare in a desert environment in accordance with FM 90-3, FM 21-76 and Newsletter No. 90-7, Special Edition, Aug 90.

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LESSON ONE

CHARACTERISTICS, WEATHER INJURIES, AND EFFECTS OF CHANGES WITHIN THE DESERT ENVIRONMENT

OVERVIEW

TASK DESCRIPTION:

In this lesson, you will learn to identify and select the characteristics of the desert in accordance with the key word "METT-T" (Mission, Enemy, Terrain, Troops and Time available). You will learn to identify and plan for special considerations in the prevention, identification, and treatment of hot and cold weather injuries in the desert. Also you will learn how to determine the effects of changes within the environment to include battlefield lights, noises and range estimation.

LEARNING OBJECTIVE:

TASKS:	Identify and select the characteristics of the desert in accordance with the key word "METT-T" (Mission, Enemy, Terrain, Troops and Time available). Identify and plan for special considerations in the prevention, identification, and treatment of hot and cold weather injuries in the desert. Describe the effects of changes within the desert environment to include battlefield lights, noises and range estimation.
CONDITIONS:	You will be given information from FM 90-3, FM 21-76 and Newsletter No. 90-7, Special Edition, Aug 90.
STANDARDS:	Identify and select the characteristics of the desert in accordance with the key word "METT-T" (Mission, Enemy, Terrain, Troops and Time available), identify and plan for special considerations in the prevention, identification, and treatment of hot and cold weather injuries in the desert, and describe the effects of changes within the desert environment to include battlefield lights, noises and range estimation in accordance with FM 90-3, FM 21-76 and Newsletter No. 90-7, Special Edition, Aug 90.
REFERENCES:	The material contained in this lesson was derived from the following publications: FM 90-3; FM 21-76 Newsletter No. 90-7, Special Edition, Aug 90.

INTRODUCTION

The desert is harsh. It can easily kill an unprepared soldier. Besides making living conditions extremely uncomfortable, the desert can pose a constant challenge to every soldier. Each must be physically, mentally, and professionally prepared to meet that challenge. Survival in a desert, as in any area, depends upon your knowledge of the terrain and the basic climatic elements, your ability to cope with them, and your will to live.

This lesson describes the characteristics and changes of the desert's environment and its effects of hot and cold weather injuries.

PART A - CHARACTERISTICS OF THE DESERT ACCORDING TO MISSION ENEMY, TERRAIN, TROOPS, AND TIME AVAILABLE (METT-T)

You must understand the desert environment to prepare for desert operations, fight in the desert environment, and provide the combat service support required for successful desert operations.

1. Desert Environment.

Deserts are arid, barren regions of the earth incapable of supporting normal life due to lack of fresh water. Temperatures vary according to latitude and season. They range from over 136 degrees Fahrenheit (57.78 degrees Centigrade) in Mexico and Libya to the bitter cold of winter in the Gobi Desert in East Asia.

Figure 1-1 shows the desert areas of the world. In some deserts, the day to night temperatures vary as much as 70 degrees Fahrenheit.

Some animals and plants have adapted successfully to desert conditions where annual rainfall may vary from zero to 10 inches and is often unpredictable. Desert terrain and vegetation varies considerably from place to place, the sole common denominator being the LACK OF WATER. This environment can profoundly affect military operations.

You must realize that deserts are affected by seasons. Those in the Southern Hemisphere have a summer between 21 December and 21 March. This six-month difference from the United States is important when considering equipping, training and acclimatizing soldiers for desert operations south of the equator.

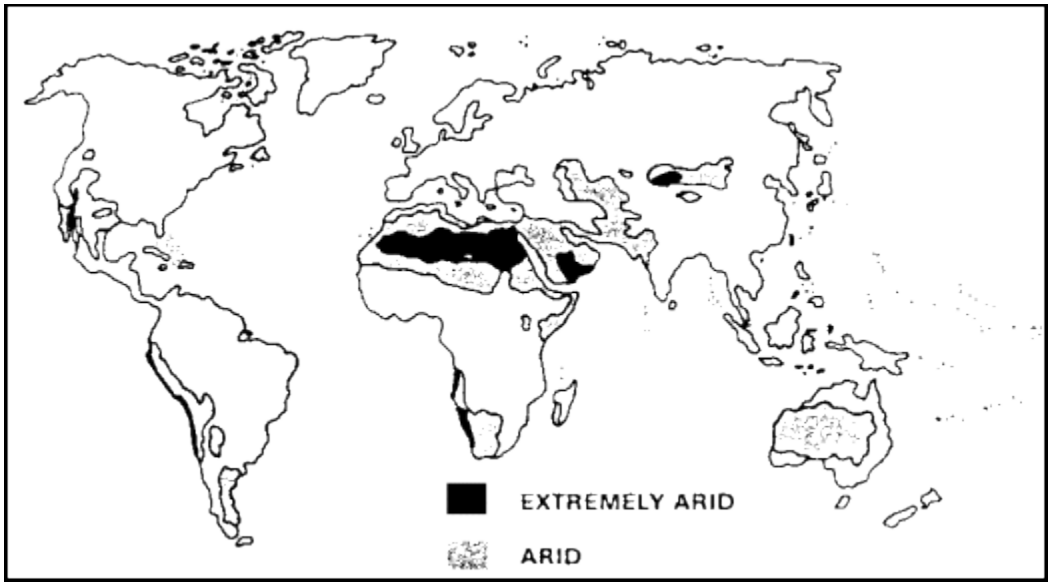

Figure 1-1. Desert Areas of the World

2. Desert Terrains.

There are three basic types of deserts: mountain, rocky plateau, and sandy or dune deserts. Besides their unique terrains, two other types of terrain, the salt marsh and the highly dissected terrain (called

"gebel"), seem to blend into other types of terrain. These types of terrains will not only affect your ability to find water, food, and shelter, they will also

- make physical movement quite demanding.
- make land navigation difficult.
- limit cover and concealment.

a. Mountain. Mountain deserts are characterized by scattered ranges or areas of barren hills or mountains, separated by dry, flat basins, as shown in Figure 1-2. High ground may rise gradually or abruptly from flat areas, to a height of several thousand feet above sea level. Most of the infrequent rainfall occurs on high ground and runs off rapidly as a flash flood. This erodes deep gullies and ravines and deposits sand and gravel around the edges of the basins. Water rapidly evaporates, leaving the land as barren as before, perhaps with short lived vegetation. If enough water enters the basin to offset the rate of evaporation, shallow lakes may develop, mostly with high-salt content. Examples are the Great Salt Lake in Utah or the Dead Sea in the Near East.

Mountain deserts at high altitudes have thin air and little or no vegetation. Sunburn is a danger. Climbing at high altitudes requires extra physical exertion and increases your need for water. Movement on mountains during darkness is extremely dangerous.

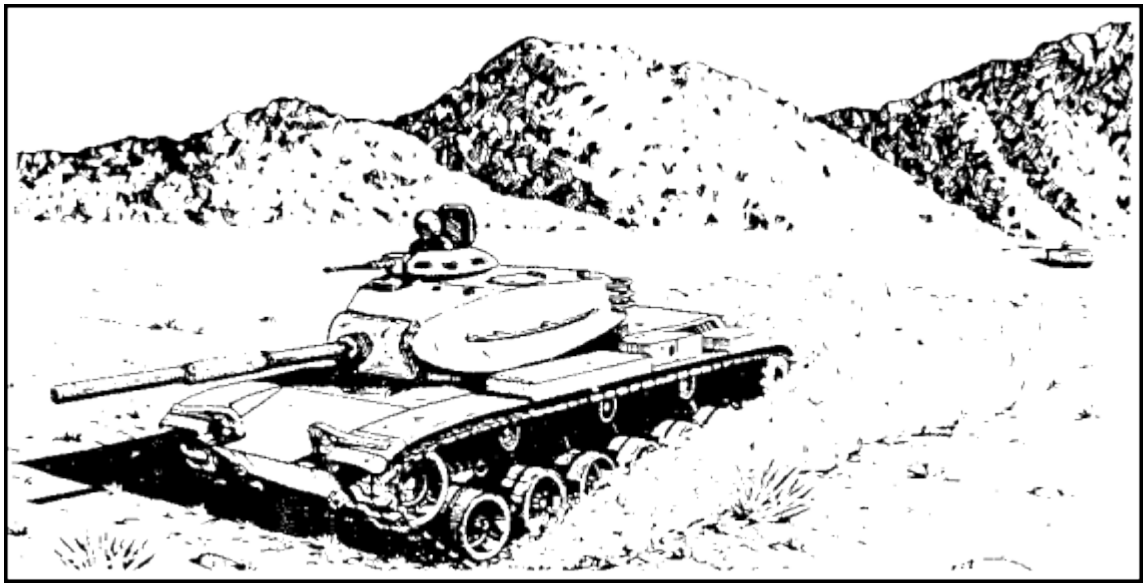

Figure 1-2. Mountain Desert - (Yemen) (Aden).

b. Rocky Plateau. Rocky plateau deserts have slight relief interspersed by extensive flat areas with quantities of solid or broken rock at or near the surface, as shown in Figure 1-3. The rocks often form natural cisterns that collect water after rains. Look closely for these areas. Sometimes animal or bird indicators, such as trails, droppings, or birds in flight, may point out water sources.

There may be sand dunes around the plateau and rock out croppings that offer shade as well as cover and concealment. Movement at night is dangerous.

You may find cut or dry, steep-walled eroded valleys, known as "wadis" in the Middle East and "arroyos" or "canyons" in the United States and Mexico. Their flat bottoms may be superficially attractive as assembly areas. However, the narrower of these valleys can be extremely dangerous to men and material due to flash flooding after rains. The Golan Heights is an example of rocky plateau desert.

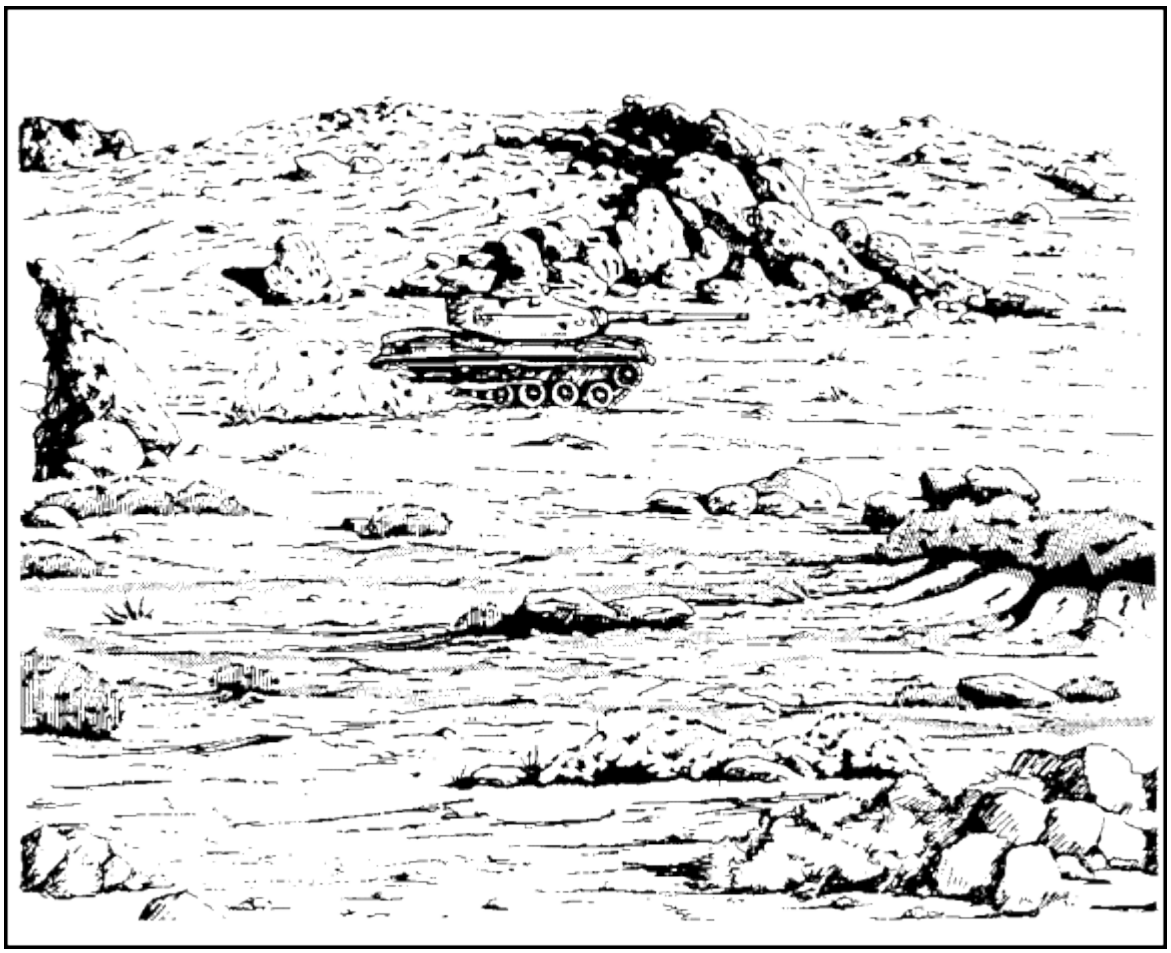

Figure 1-3. Rocky Plateau Desert - The Golan Heights.

c. Sandy or Dune. Sandy or dune deserts are extensive flat areas covered with sand or gravel, the product of ancient deposits or modern wind erosion, as shown in Figure 1-4. "Flat" is relative in this case, as some areas may contain sand dunes that are more than 1,000 feet high and 10 to 15 miles long. Traffic conditions in such terrain will depend on windward/leeward gradients of the dunes and texture of sand. Other areas, however, may be flat for 3,000 meters and beyond. Plant life may vary from none to scrub reaching more than two meters high. Sand dune deserts include the ergs of the Sahara, The Sinai Desert, the Empty Quarter of the Arabian Desert, areas of California and New Mexico, and the Kalahari in South Africa. You should avoid travel through sand dune deserts if possible.

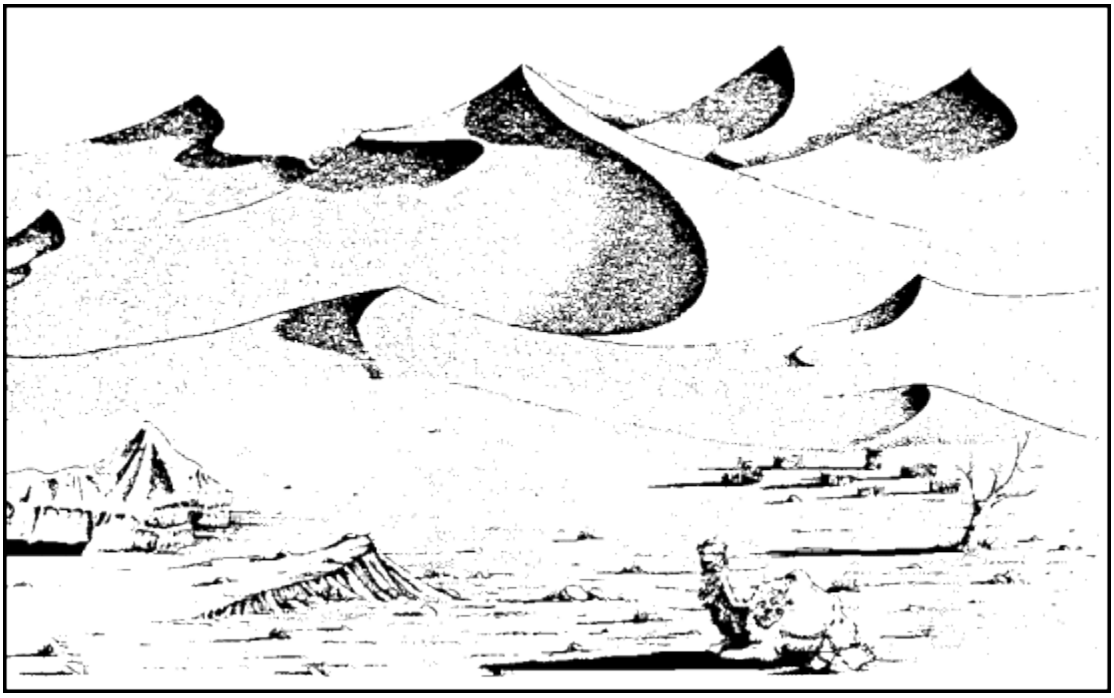

Figure 1-4. Dune Desert - Western Sahara.

d. Salt Marshes. Salt marshes are flat, desolate areas, sometimes studded with clumps of grass, but devoid of other vegetation. They are in arid areas where rainwater has collected, evaporated, and left large deposits of alkali salts. Any water is so salty it is undrinkable. A crust, which may be from two to 30 centimeters thick, forms over the saltwater. In arid areas there are salt marshes hundreds of kilometers square. These areas support many insects, most of which bite. Avoid salt marshes. These types of terrain are highly corrosive to boots, clothing, and skin.

e. Dissected Terrain (Gebel). You find highly dissected terrain in all arid areas. Rainstorms erode soft sand and carve out miniature canyons, sometimes called gebel or wadi. A wadi may range from three meters wide and two meters deep to several hundred meters wide and deep. The direction it takes varies as much as its width and depth, twisting and turning, forming a maze. You can easily become lost because of this maze-like pattern. A wadi will give you good cover and concealment, but you should not try to move through it.

3. Desert Driving Techniques.

a. Sand. A sandy desert may be nearly flat or broken up by dunes. The best time to drive on sand is at night or early morning when the sand is damp and traction is better. A surface crust, caused by chemicals cementing sand particles together, covers some areas. In some cases, it is possible to drive on this crust to keep the dust down. Use the following techniques when driving in sand.

(1) Before entering sand, you should select a gear that will allow the vehicle to keep as much torque as possible without causing the wheels to spin and to minimize changing gears.

(2) A lack of steering response in a tracked vehicle indicates that sand is building up between the rear sprockets and the treads. If you allow this to continue, the sand will

build up and force the track off. You can throw the sand off by "shaking" the vehicle with the steering or by backing up. You must evenly distribute vehicle loads and use rear-wheel drive where necessary to avoid digging in the front wheels. Drivers should switch to all-wheel drive or change gears before a vehicle becomes bogged down.

(3) Crossing dunes requires careful reconnaissance. Normally, a crust that has a fairly gradual slope covers the upwind side of a dune. The downwind side will be steeper and have no crust. Before crossing a dune, you should climb it on foot, checking the

- crust thickness.
- angle of the crest to be sure that the vehicle will not become bellied up at the top.
- degree of slope and softness of the downwind side.

Once you're satisfied, you can drive the vehicle straight up the slope at best possible speed and crest the dune. Maintain a controlled descent on the other side.

b. Hillocks. Hillocks are little hills built up by the wind blowing sand around small shrubs. You should not drive wheeled vehicles through these areas without engineering assistance.

c. Thorns. Thorn bushes or cacti can cause frequent tire punctures. When operating in these areas, you need to increase the number of tires carried in your unit's PLL.

d. Rocks. Rock and boulder-strewn areas, including lava beds, can extend for miles. There are so many eroded and sharp-edged desert rocks, that it is almost impossible to avoid any but the largest. The harsh jolting will wear you out and severely wear tracks, wheels, springs and shock absorbers. Vehicles can follow one another in this type of terrain, and it may be possible to reconnoiter and mark a route. While crossing large rocks, drivers should try to get a rolling effect by braking as the wheels ride over a rock so the axle settles gently on the other side.

4. Climate and Weather Conditions.

In an arid area, there are some environmental factors you should consider.

a. Temperatures. The highest known ambient temperature recorded in deserts was 136.4 degrees Fahrenheit (58 degrees Centigrade). Lower temperatures than this produced internal tank temperatures approaching 160 degrees Fahrenheit (71 degrees Centigrade) in the Sahara Desert during the Second World War. The temperature of desert sand and rock averages 30 to 40 degrees more than that of the air. For instance, when air temperature is 110 degrees, the sand temperature may be 140 degrees.

Temperatures may get as high as 130 degrees Fahrenheit (54 degrees Centigrade) during the day and as low as 50 degrees during the night in arid areas. The drop in temperature at night occurs rapidly. A person who lacks warm clothing and is unable to move about, will chill quickly. The cool evenings and nights are the best times to work or travel. If you plan to rest at night, you may want to use a wool sweater, long underwear, and a wool stocking cap.

Temperatures during winter in USSR deserts and in the Gobi Desert can reach minus 50 degrees Fahrenheit (minus 45 degrees Centigrade). Low temperatures can be aggravated by very strong

winds that produce high wind chill factors. The cloudless sky of the desert permits the earth to heat during sunlit hours, yet cool to near freezing at night. In the inland Sinai, for example, day to night temperature fluctuations can be as much as 72 degrees Fahrenheit. This imposes an unusual strain on personnel and sometimes affects equipment.

b. Winds and Sandstorms.

(1) Winds. Desert winds can achieve almost hurricane force. The effects of such force can be seen in Figure 1-5. Suspended dust and sand can make life almost intolerable, maintenance very difficult, and restrict visibility to a few meters. The Sahara Khamseen, for example, can last for days at a time. Although, it normally only occurs in the spring and summer. The "Seistan" desert wind in Iran and Afghanistan blows constantly from the north at 75 miles per hour for up to 120 days.

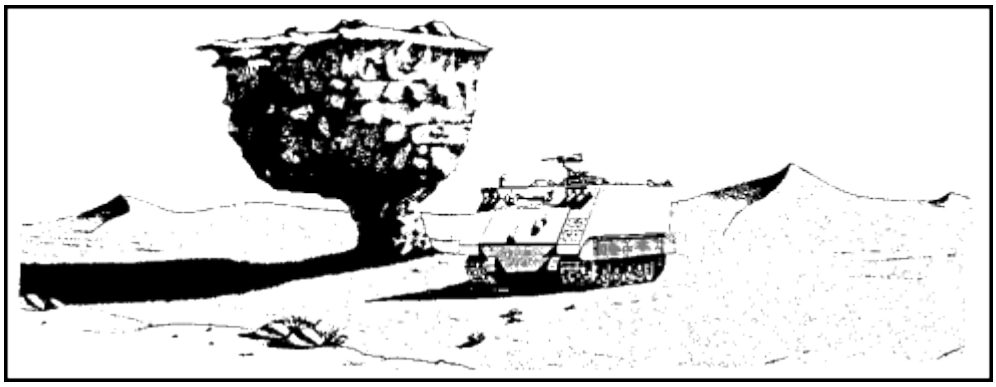

Figure 1-5. Wind Erosion Sahara.

(2) Sandstorms. Sandstorms (sand-laden winds) occur frequently in most deserts. Within Saudi Arabia, winds average 2 to 3 miles per hour (mph) and can reach 70 to 80 mph in early afternoon. You can expect major sandstorms and dust storms at least once a week. The greatest danger is getting lost in a swirling wall of sand. You should wear goggles and cover your mouth and nose with cloth. If natural shelter is unavailable, mark your direction of travel, lie down, and ride out the storm. Although no danger of a man being buried alive by a sandstorm exist, individuals can become separated from their units. In all deserts, rapid temperature changes follow strong winds. Dust and wind-blown sand interfere with radio transmissions.

c. Rain. The common characteristic of all deserts is their aridity. In areas of the Atacama in Chile, for example, no rainfall has been recorded for several years. When rain does occur, it may consist of one single violent storm in a year. Figure 1-6 shows high surface water run-off which, depending on soil consistency, will either reduce trafficability in loam of wadi areas or somewhat improve it if the terrain is pure sand. Precipitation may occur in the form of hail even though ground temperature is over 90 degrees Fahrenheit (32 degrees Centigrade).

Figure 1-6. Wadi After Rainstorm Sahara.

WARNING

BEWARE OF RAIN CLOUDS YOU SEE IN THE DISTANCE.
STAY OUT OF WADIS!

When it rains, it's usually too much too quickly, and it is likely to be a liability rather than an asset. Some desert areas receive less than four inches of rain annually, and this comes in brief torrents that quickly run off the ground surface. Rain occurring as much as several hundred kilometers away can cause flooding in another distant location. Dry stream beds can suddenly become extremely hazardous as a channel of flooding. Therefore, reduce the time you spend in these low-lying areas. Do not set up camp in dry stream beds. Stories of walls of water 10 feet high roaring through them are true.

With the high desert air temperatures you cannot survive long without water. So in a desert survival situation, you must first consider "How much water do I have?" and "Where are other sources?"

d. Lightning. Lightning strikes frequently in the desert. Don't panic, keep exposure down to a minimum. Remember, track vehicles are grounded. You're better off inside than running around in the open.

5. Vegetation.

Vegetation is sparse in arid areas. You therefore will have difficulty finding shelter and camouflaging your movements. During daylight hours large areas of terrain are visible and easily controlled by a small opposing force. The indigenous vegetation and wildlife of a desert have adapted to the conditions. Some plants have extensive lateral root systems to take advantage of the occasional rain. Others have deep roots to reach subsurface water. For example, a palm tree indicates water within two to three feet (one meter) of the surface; salt grass implies that the water table is within six feet (two meters); cottonwood and willow trees indicate water at a depth of 10 to 12 feet (two to three meters). Other plants such as American cactus provide you no relation to the water table since they store moisture in enlarged stems. Some plants have drought-resistant seeds that lie dormant for years. Then,

they have a brief colorful growth after a rainstorm. The available vegetation is usually inadequate to provide much shade, shelter, or concealment, especially from the air. Lack of natural concealment may induce temporary agoraphobia (fear of open spaces) in some soldiers new to desert conditions. This fear normally disappears after climatizing to the conditions.

6. Wildlife.

CAUTION

BEFORE PUTTING CLOTHES ON IN THE FIELD, CHECK FOR CRITTERS!

a. Invertebrates. Ground-dwelling spiders, scorpions, centipedes, and insects of most types, are found in quantity in the desert. Lice, mites, and flies, drawn to people for moisture or food, are not only extremely unpleasant, but they carry diseases such as scrub typhus and dysentery. The stings of many scorpions and the bites of centipedes or spiders can be extremely painful, though seldom fatal. However, some species of scorpion, black widow or recluse spiders can cause death.

b. Reptiles. Reptiles are the most characteristic group of desert animals. Lizards and snakes occur in quantity, and crocodiles are common in some desert rivers. Lizards normally are harmless. Although, exceptions occur in North America and Saudi Arabia. Also, you should avoid desert snakes since they can be extremely dangerous.

WARNING

DON'T PLAY WITH SNAKES!

CAUTION

WATCH WHERE YOU STEP. SNAKES ARE ESPECIALLY ACTIVE AT NIGHT DURING HOT WEATHER, AND YOU MAY SEE THEM COILED IN SHADY SPOTS DURING THE DAY.

c. Mammals. The camel is the best known variety of specialized mammal life in the desert. Like most desert mammals, the urine of the camel is very concentrated to reduce water loss. A camel can lose 30 percent of its body weight without suffering distress. A proportionate loss would be fatal to man. The camel can regain this weight by drinking up to 27 gallons (120 liters) of water at a time. It cannot, however, continue indefinitely without water and can die of dehydration as easily as man in equivalent circumstances. Other mammals, such as gazelles, get all or most of their required water supply from the vegetation they eat and may live in areas where there is no open water. Smaller animals like rodents conserve their moisture by burrowing underground away from the direct heat of the sun, only emerging for foraging at night. These animals have adapted to the environment over thousands of years. Man has not done so and must carry his food and water with him.

CAUTION

BE CAREFUL WHERE YOU SLEEP IN THE DESERT!

d. Sleep Protection. The desert has few areas that offer protection, such as trees, from large vehicles. During short halts, sleep in or on your vehicle. When halting for more than an hour or more, designate a sleeping area that has a protective perimeter and always let someone know where you plan to sleep. When moving vehicles into an area where troops might be sleeping, use ground guides to look for sleeping troops. The ground is hotter than the air above so do not sleep directly on the ground, sleep on a cot. Snakes, spiders, and scorpions don't get to you so easily if you're on a cot.

7. Man-Made Characteristics.

a. Roads and Trails. Roads and trails are scarce in the open desert. There may be only simple commercial links. Some surfaces, such as lava beds or salt marsh, may prevent any form of routine vehicular movement. Ground transportation can often travel in any direction necessary. Speed of movement will vary depending on surface texture. Road systems that exist may have been used for centuries to connect centers of commerce, or important religious shrines, such as Mecca and Medina in Saudi Arabia. These road systems are supplemented by routes joining oil or other mineral deposits to collection outlet points. Many deserts have rudimentary trails for use by minor caravans and nomadic tribesmen. There may be wells or oases approximately every 20 to 40 miles (32 to 64 kilometers), although, there are some waterless stretches more than 100 miles (160 kilometers).

Trails vary in width from a few meters to more than 800 meters. In mountainous desert country, the enemy or climatic conditions can block available routes. Hairpin turns will be present on the edges of precipitous mountain gorges. Snow in winter may block the higher passes. The distances on foot or animal between two points in the mountains may be less than a tenth of the vehicular route.

b. Structures. Local inhabitants of deserts live in thick-walled structures with small windows, usually built of masonry or a mud and straw (adobe) mixture as shown in Figure 1-7. Nomadic tribesmen live in tents as shown in Figure 1-8. Conditions are such, that it will be difficult for you to find wood, since what is available is probably all ready in use.

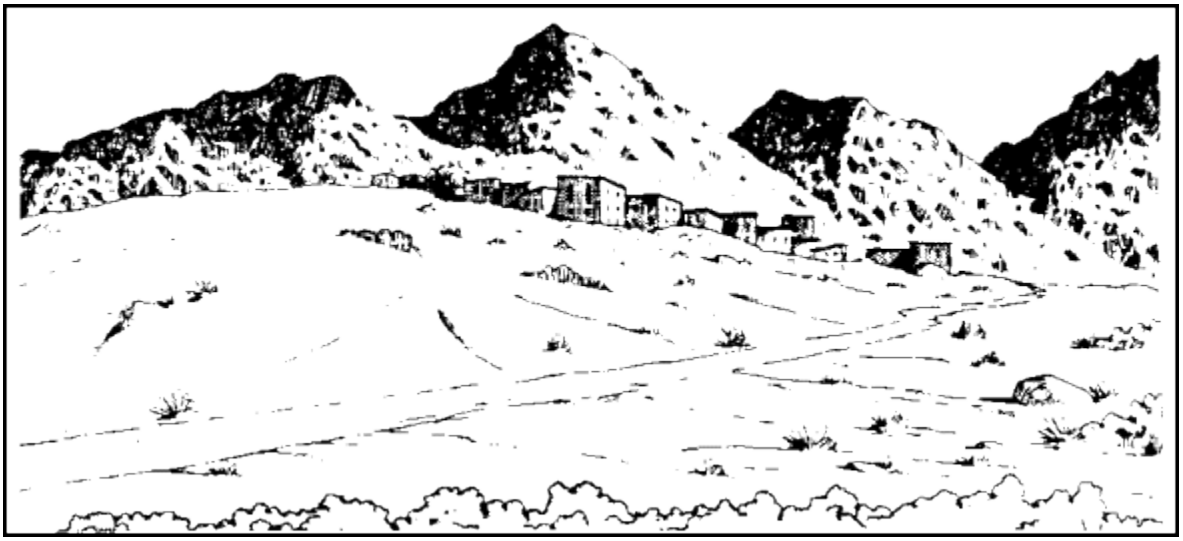

Figure 1-7. Man-made desert structures.

Scattered across the deserts are the ruins of earlier civilizations. You may find ancient posts and forts in ruins. They usually command important avenues of approach and frequently dominate the only available passes in difficult terrain. Control of these positions may be crucial for any force intending to dominate the immediate area.

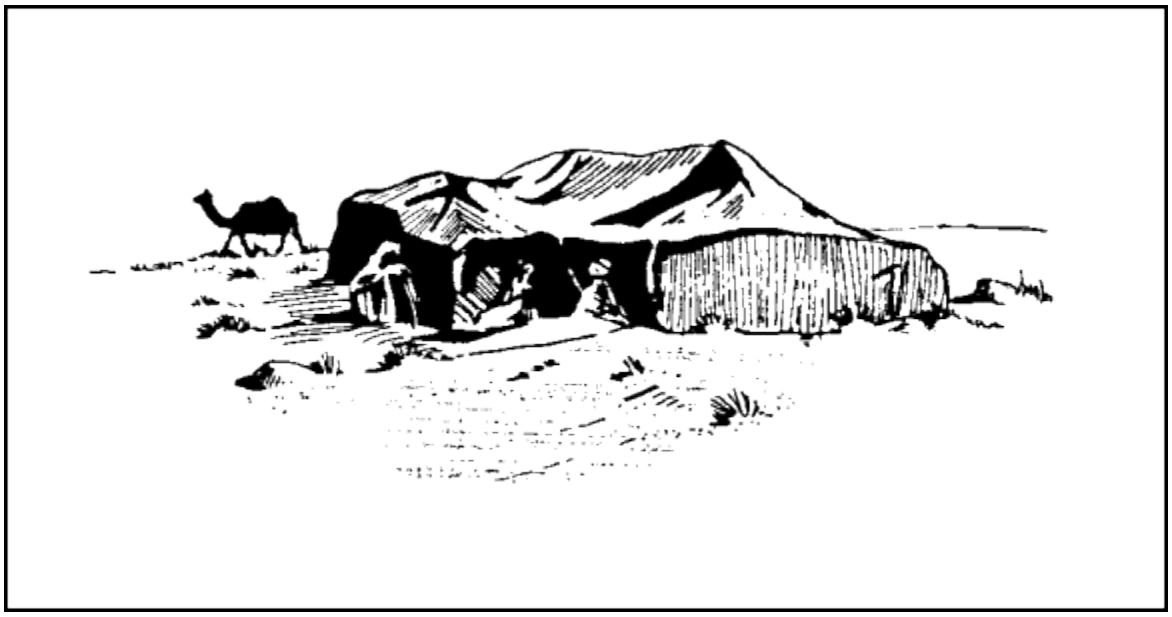

Figure 1-8. Desert Nomad Tents.

8. Resources.

a. Water. The lack of water is the most important single characteristic of the desert. Thus the population, if any, varies directly with the local water supply.

(1) Water Supply. Figure 1-9 shows a Sahara Oasis that, for its size, is one of the most densely occupied places on earth. There are permanent rivers such as the Nile, the Colorado, or the Kuiseb in the Namib Desert of Southwest Africa. Fed by heavy precipitation outside the desert, the river survives despite a high evaporation rate.

Ground water in such places as oases and near-surface wells is caused by subsurface seepage from considerable distances. The water you drink in a Sahara Oasis may have fallen as rain in the highlands of the south before the time of Christ.

Subsurface water may be so far below the surface, or so limited, that wells are normally inadequate to support any large number of people. Therefore, never take for granted any potable water supplies. You must maintain an adequate, uninterrupted supply. Thus, a large natural water supply may be both tactically and strategically important. Destruction of a water supply system may become a matter of political decision, rather than military, because of its lasting effects on the resident civilian population.

Figure 1-9. Typical Oasis - Egypt.

(2) Physical Need for Water. The subject of man and water in the desert has incited considerable interest and confusion since the early days of World War II when the U.S. Army was preparing to fight in North Africa. At one time the U.S. Army and the Israeli Defense Forces thought they could condition men to do with less water by progressively reducing their supplies during training. They called it water discipline. It caused hundreds of heat casualties.

NOTE: You can't drink too much water!

A key to arid area survival is understanding the relationship between physical activity, air temperature, and water consumption. The body requires a certain amount of water for a certain level of activity at a certain temperature. A man performing hard work in the sun at 110 degrees Fahrenheit (43.3 degrees Centigrade) needs five gallons of water a day. Lack of the required amount of water causes a rapid decline in a person's ability to decide and to perform tasks efficiently.

Your body's normal temperature is 98.6 Fahrenheit (37 degrees Centigrade). Your body gets rid of excess heat by sweating. You sweat more as your body becomes warmer, whether caused by work, exercise, or air temperature. The more you sweat, the more moisture you lose. Sweating is the principal cause of water loss. A man will have a heat stroke if he stops sweating during periods of high air temperature and heavy work or exercise. This emergency requires immediate medical attention.

(3) Survival. Take measures to get the most from your water supply by understanding how air temperature and your physical activity affect your water requirements. These measures are:

- Find shade. Get out of the sun. Place something between you and the hot ground and limit your movements.

- Conserve your sweat. Wear your complete fatigue uniform including your T-shirt. Roll your sleeves down, cover your head, and protect your neck with a scarf or similar item to protect your body from hot blowing, sand-laden winds and the direct rays of the sun. Your clothing will absorb your sweat and keep it against your skin so you gain its full cooling effect. Your water requirement for survival drops dramatically by staying in the shade quietly, fully clothed, not talking, keeping your mouth closed and breathing through your nose.
- If water is scarce, do not eat. Food requires water for digestion. Therefore, eating food will use water that you need for cooling.

THIRST IS NOT A RELIABLE GUIDE FOR YOUR NEED FOR WATER. A person who uses thirst as a guide will drink only two-thirds of his daily requirement. To prevent this "voluntary" dehydration, use the following guide.

- At temperature below 100 degrees Fahrenheit (37.78 degrees Centigrade), drink one pint of water every hour.
- At temperatures above 100 degrees Fahrenheit (37.78 degrees Centigrade), drink one quart of water every hour.

Drinking water at regular intervals helps your body to remain cool, decreasing sweating. Even when your water supply is low, sipping water constantly will keep your body cooler and reduce water loss through sweating.

NOTE: You less water if you keep your clothes on!

Conserve your sweat by reducing activity during the heat of day. DO NOT ration your water. If you try to ration water, you stand a good chance of becoming a heat casualty.

b. Minerals. In many desert areas, such as the Middle East, there is exploration for and exploitation of minerals, of which oil is the best known. Wells, pipelines, refineries, quarrying and crushing plants may be of strategic and tactical importance. Pipelines, often raised one meter off the ground, can inhibit your movements.

All arid regions have areas where the surface soil has a high mineral content (borax, salt, alkali, and lime). Material in contact with this soil wears out quickly. Water in these areas is extremely hard to find and undrinkable. Wetting your uniform in such water to cool off may cause a skin rash. The Great Salt Lake area in Utah is an example of this type of mineral-ladened water and soil. Avoid these types of areas, if possible. There is little or no plant life there and shelter is hard to find.

c. Agriculture. Many desert areas are fertile when irrigated, and some desert villages depend on irrigation canals, as shown in Figure 1-10. Agriculture in these areas has little affect on military operations except canals, which may limit surface mobility. The effect of the destruction of an irrigation system on the local population may become an important consideration in an operation estimate.

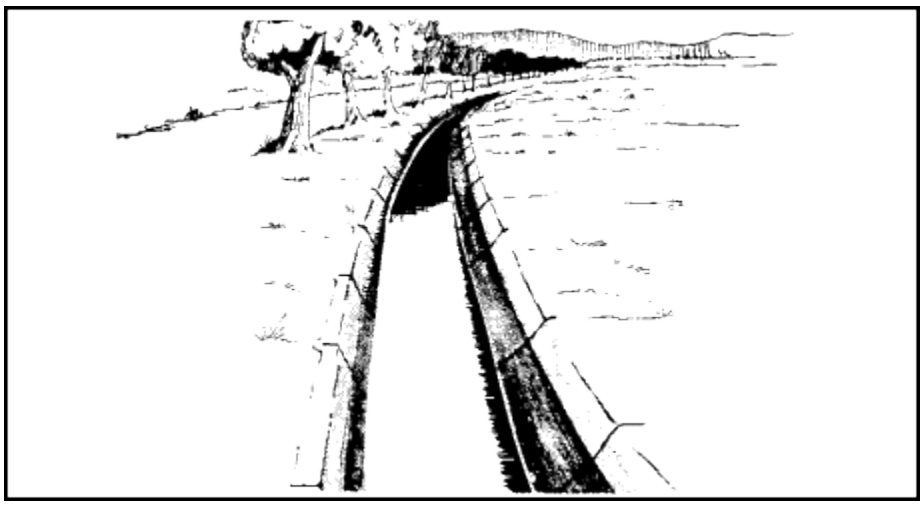

Figure 1-10. Irrigation Ditch - An Effective Tank Obstacle.

9. Navigation.

a. Navigation Effectiveness. A force may be equipped with modern, sophisticated navigation means with the ability to record positions with errors of less than one percent. A force not equipped with such systems may find navigation difficult, depending on the number of visible and known terrain features, and the reliability of local maps.

A specific person, qualified in celestial navigation and whose primary task is navigation, is often appointed by each company team and battalion task force.

Thoroughly brief soldiers on the type of terrain and the general environment they will encounter, including:

- Water sources, if any.
- Landmarks or significant permanent terrain features.
- Friendly and enemy areas of operation.
- Prevailing winds.

This information will assist navigation by reconnaissance units or individuals who become separated from their units.

b. Route Reconnaissance. To compensate for a lack of adequate maps, it is best to reconnoiter desert operations areas in advance of large-scale troop movements. Route reconnaissance is especially important in field artillery. Alternate and supplemental positions should be seen ahead of time. Go over and mark proposed and alternate routes. If possible, guides should return to the main element at the completion of the reconnaissance to help the unit stick to the prescribed routes of march. Deviation from planned routes can cause lengthy delays and breakdowns that will ultimately degrade available fire support. Thorough ground reconnaissance and adherence to prescribed routes of march will improve artillery fire support in desert operations.

c. Routes of March. There are few hard surface roads within the interior of Saudi Arabia, for example, but many of them are ill maintained. Secondary gravel roads and trails crisscross the landscape, but they are also ill maintained and frequently are like driving on a "washboard." Except for the main arteries, there are few road signs or trail markers except those constructed by the bedouins. Routes of march will quite often be cross-country over rugged and hanging terrain with only partially adequate maps and a compass.

d. Evasion. As an evadee, you should follow the principles of desert camouflage:

- Hide or seek shelter in dry washes (wadis) with thicker growths of vegetation and cover from oblique observation.
- Use the shadows cast from brush, rocks, or outcroppings. The temperature in shaded areas will be 20 to 30 degrees cooler than the air temperature.
- Cover objects that will reflect the light from the sun.

Before moving, survey the area for sites that provide cover and concealment. You will have a problem estimating distance. The emptiness of a desert terrain causes most people to underestimate distance by three: what looks like one mile (1.61 kilometers) away is really three miles (4.83 kilometers) away.

e. Lost or Stranded. People die every year in the desert because they don't know what to do if lost or stranded. It is a good idea to have at least two vehicles in your traveling party. Use the buddy system. When driving, avoid going down steep slopes your vehicle may not be able to climb back up. Look for washouts, large rocks, and deep sand. If you get stuck, try jacking the vehicle up and then placing boards, brush, or blankets under the tires. Always let someone, friends or superiors, know

- where you are going.
- when you plan to return.
- when to start searching if you don't return.

Note: Don't forget to check in when you return.

If lost, don't panic. Remember the sun rises in the east and sets in the west. When leaving your field site, know the direction in which you are departing. If needed, make a field expedient compass:

- Put a stick in the ground, and lay a rock at the end of the shadow from the stick.
- Wait 15 minutes.
- Draw a line from the rock to the new end of the shadow. The line represents the east-west line.
- In the morning, the rock will be the west end; in the afternoon, the rock will be the east end.

If your vehicle breaks down, stay near it. Your emergency supplies are there. Your vehicle has many items that are useful in an emergency. Raise the hood to show you need help. A vehicle can be seen for

miles, but a person on foot is very difficult to find. Tie a white or light-colored cloth to your antenna. Use mirrors and burn oil for signaling. When not moving, use available shade. You can make shade by erecting tarps, blankets, seat covers or anything to reduce the direct rays of the sun.

CAUTION

DO NOT SIT OR LIE DIRECTLY ON THE GROUND; IT CAN BE HOTTER THAN THE AIR BY 30 DEGREES OR MORE. IF YOU HAVE WATER, DRINK IT. DO NOT RATION IT.

If water is limited, keep your mouth shut. DO NOT talk, eat, smoke, drink alcoholic beverages, or take salt.

CAUTION

KEEP YOUR CLOTHING ON; IT HELPS KEEP THE BODY TEMPERATURE DOWN AND REDUCES THE DEHYDRATION RATE. COVER YOUR HEAD. IF A HAT OR CAP ISN'T HANDY, IMPROVISE.

PART B - PREVENTION, IDENTIFICATION AND TREATMENT OF HOT AND COLD WEATHER INJURIES IN THE DESERT

No matter how much instruction people receive on how to avoid becoming overheated, some heat casualties will occur.

1. Heat Casualties.

Your body regulates its temperature within very narrow limits. Too little salt may lead to heat cramps and too little salt and not enough water may lead to heat exhaustion. A general collapse of the body cooling mechanism will lead to potentially fatal heat stroke. To avoid these illnesses, you must be physically fit, thoroughly acclimatized, and drink sufficient water with necessary salt. If you expend more calories than you take in, you will be more prone to heat illnesses. Your people may lose their desire for food in hot climates, so you must encourage them to eat. Schedule the heavier meal of the day for the cooler hours.

Continued supervision by commanders and the use of the buddy system are important, especially for those personnel, such as mechanics, who work alone or in pairs. You must recognize heat stress symptoms quickly. When a person is suffering from heat stroke, they will have a tendency to creep away from their comrades and try to hide in a shady and secluded spot. If not found and treated, they will die. You can prevent heat stroke by providing shade during the day. Use tarpaulins or camouflage nets, preferably doubled to allow air circulation between layers. Dampened them with any surplus water.

The following are the major types of heat casualties and their treatment when little water and no medical assistance are available:

a. Heat Cramps. Heat cramps are caused mainly by loss of salt due to excessive sweating. Symptoms of heat cramps are moderate to severe muscle cramps in legs, arms, back or

abdomen and a normal body temperature. These symptoms may start as mild muscular discomfort. When this occurs, you should stop all activity, get in a cool shaded place, and drink water. Promptly relieve heat cramps by replacing the salt lost from the body. If you fail to recognize early symptoms and continue with physical activity, you will have severe muscle cramps and pain. To treat a patient with heat cramps, take the following steps immediately:

- Get the patient under shade. Make him lie on a stretcher or similar item approximately 18 inches off the ground.
- Loosen the patients clothing.
- Elevate the patient's feet and either move legs up and down or massage them.
- Sprinkle the patient with water, and fan him.
- Give the patient all the water he can drink in small amounts in the form of 0.1 percent saline solution.
- Ensure the patient remains quiet and rests.
- Refer the patient to a medical officer.

b. Heat Exhaustion. Heat exhaustion results from a large loss of body water and salt. Symptoms are headache, mental confusion, irritability, excessive sweating, weakness, rapid pulse and breathing, dizziness, vomiting, cramps, and pale, moist, cold (clammy) skin. There may be a slight rise in temperature. Treat a patient for heat exhaustion using the same immediate steps as listed above for heat cramps:

c. Heat Stroke. Heat stroke is a severe heat injury caused by extreme loss of water (collapse of body cooling mechanism) and salt and the body's inability to cool itself. Temperature is high (106 or more). The patient may die if not immediately cooled. Symptoms are no sweating, hot, dry skin, headache, weakness, dizziness, rapid breathing, fast pulse, nausea and vomiting, and mental confusion and bizarre behavior leading to unconsciousness. Heat stroke is a medical emergency, seek the aid of a medical officer at once. The lowering of the patient's body temperature as rapidly as possible is the most important objective. To treat a patient with heat stroke, take the following steps immediately:

- Get the patient in shade. Lay him on a stretcher or similar item approximately 18 inches off the ground.
- Loosen the patient's clothing.
- Sprinkle water on the patient or bathe him (it does not matter if the water is polluted or brackish), fan him to increase the cooling effect.
- Massage the patients's arms, legs, and body.
- If the patient regains consciousness, let him drink small amounts of water every three minutes.
- For medical evacuation, continue treatment on the way.

2. Heat Illness Prevention.

An individual who has had a heat stroke or a severe case of heat exhaustion is more likely to fall sick again than one who has not suffered from these illnesses. Hence, individuals once affected should be subsequently exposed to heat stress with caution.

The following symptoms can distinguish between salt depletion and water depletion.

Symptoms	Salt Depletion	Water Depletion
Duration of symptoms	3 to 5 days	1 day
Thirst	seldom	prominent
Fatigue	prominent	seldom
Cramps	prominent	none
Vomiting	prominent	none
Weakness	progressive	acute

a. Water Requirements Guide. This guide is based on 80 degrees Wet Bulb Globe Temperature (WBGT) which equals approximately 105 degrees Fahrenheit (40.5 degrees Centigrade) dry bulb temperature in a hot dry desert. The dry bulb temperature inside a tank may be significantly higher than the outside temperature. Vehicles of some countries have inside insulation, and some vehicles have air conditioning. You will need extra water for cooking, vehicle radiators, etc.

Quarts per man per day for drinking.

Activity	Typical Duties	Under 80 degrees	Over 80 degrees
Light	Deskwork. Guard duty Radio operating.	6	10
Moderate	Route march on level ground. Tank operations.	7	11
Heavy	Forced marches. Route marches with heavy loads or CBR clothing. Digging in.	9	13

b. Salt Requirements Guide. Described below are two methods of making up a solution of 0.1 percent salt in drinking water. Use table salt throughout, and vigorously stir or shake the container after adding the salt. To prepare the solution (approx. 26 percent), dissolve 9 level table spoons of salt in 2/3 canteen cup water. Follow logical progression; that is, 3 spoonfuls to 3 gallons, 12 spoonfuls to 12 gallons, etc.

NOTE: Check your current SOP for doctrine that may advise against taking salt tablets under certain conditions.

(1) Addition of Table Salt to Water

Table Salt	Amount of Water
2 ten-grain crushed salt tablets or 1/4 teaspoon	1-quart canteen
4 ten-grain crushed salt tablets	2-quart canteen
1 1/3 level mess kit spoons	5-gallon can
9 level mess kit spoons or 3/10 pound	36-gallon-lister bag
1 pound	100-gallon tank
1 level canteen cup	250 gallons (in water trailer)

(2) Addition of Saturated Salt Solution

Amount of Solution	Amount of Water
1/2 canteen cup (quart size)	1-quart canteen
1 canteen cup (2-quart size)	2-quart canteen
1 mess kit spoonful	1 gallon
2/3 canteen cup	36-gallon lister bag
4 canteen cups	250 gallons (in water trailer)

c. Acclimatization. The following schedule shows work that may be performed during a period to acclimatize soldiers in the minimum time. Full acclimatization is attained most efficiently by graded, progressively increasing work in the heat over a period of approximately 14 days. Rest days will be of limited value. Modified the schedule consistent with local conditions.

Day	Less than 80 degrees WBGT		More than 80 degrees WBGT	
	Morning	Afternoon	Morning	Afternoon
	(All figures in hours)		(All figures in hours)	
1	1	1	1	1
2	1 1/2	1 1/2	1 1/2	1 1/2
3	2	2	2	2
4	3	3	2 1/2	2 1/2
5	Regular duty		3	3
6			Regular duty	

d. Jet Lag. People arriving in Saudi Arabia from the United States need at least two or three days' after flight recovery time. Jet lag affects eating and sleeping habits, mental agility, and general attitude. A newcomer cannot "hit the ground running."

Jet lag is a serious consideration in desert operations undertaken by men arriving by plane from a great distance. Allow for a recovery period, ideally one day for every time zone crossed.

3. Precautions.

In a desert survival/evasion situation, it is unlikely that you will have a medic or medical supplies with you to treat heat injuries, so take extra care to avoid heat injuries. Rest during the day and do your work during the cool evenings. Use a buddy system to watch for heat injuries, and follow these guidelines:

- Make sure you tell your buddy where you are going and when you will return.

- Watch your buddy for signs of heat injury. If he complains of being tired or wanders away from the group, he may be a heat casualty.
- Make sure your buddy drinks water at least once an hour.
- Get in the shade when resting. Do not let your buddy lie directly on the ground.
- Do not let your buddy take off his shirt and work during the day.
- Check the color of your urine. A light color means you are drinking enough water and, a dark color means you need to drink more.

Figure 1-11 shows how you can determine a man's water needs at three activity levels in relation to the daily mean air temperature.

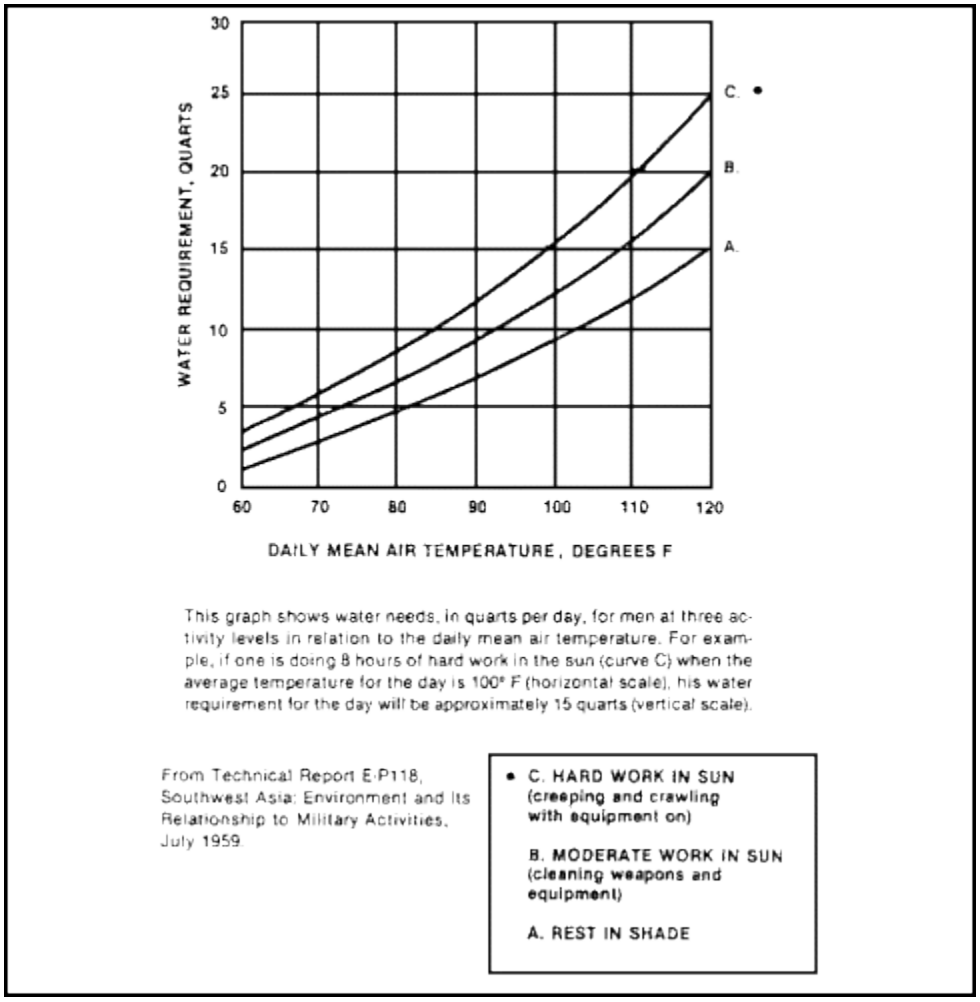

Figure 1-11. Daily Water Requirements for Three Levels of Activity.

4. Arid Area Hazards.

There are several hazards unique to desert survival. These include insects, snakes and other reptiles, thorny plants and cacti, contaminated water, sunburn, eye irritation, climatic stress, and poor personal habits.

a. Insects. Insects of most types abound in the desert. Lice, mites, wasps, and flies, which are drawn to man as a source of moisture and food, are extremely unpleasant and may carry diseases such as scrub typhus and dysentery. Some species of spiders and scorpions can cause death. Old buildings, ruins, and caves are favorite habitats of spiders, scorpions, centipedes, lice and mites. These areas provide protection from the elements and attract other wildlife. Therefore, take extra care when staying in these areas. Always wear gloves in the desert. Do not place your hands anywhere without first looking to see what is there. Visually inspect an area before sitting or lying down. When you get up, shake out and inspect your boots and clothing.

b. Snakes and Reptiles. Snakes and reptiles are found in all arid areas and snakes are probably the most common threat. They inhabit ruins, native villages, garbage dumps, caves, and natural rock outcroppings that offer shade. Never go without boots or walk through these areas without carefully inspecting them for snakes. Watch where you place your feet and hands. Most snakebites result from stepping on or handling snakes. Avoid them. Once you spot them, give them wide berth. Consider all snakes dangerous. Even a bite from a harmless snake can become infected. Take no chances and treat all snake bites as poisonous. Use the following steps for FIRST AID FOR SNAKE BITE:

(1) Remain calm, but act swiftly. Call MEDEVAC Immediately.

(2) Within practical limits, keep the bitten part very still, below the level of your heart and as cool as possible.

(3) Tie a slightly tight band or tourniquet 2 to 4 inches toward the heart from where the bite is. You can use a belt, rag or sock and a stick. Keep moving the band ahead of the swelling if it moves closer to the rest of your body. Tie the band tight enough to halt blood flow in surface blood vessels, but not tight enough to stop the pulse.

(4) If you estimate that you cannot get to medical attention within 15 to 20 minutes, make a cut over each fang mark no more than a half-inch long and one-fourth inch wide. Make the cuts along the length of the bitten limb (parallel).

(5) Apply suction to the wound. If a snakebite kit is available, use its suction pump. If none is available, apply suction by mouth, spitting out the blood and other fluids frequently. The venom is not harmful in the mouth, unless there are cuts or sores. Even so, risk is not great. Maintain suction at least 15 minutes before loosening the tourniquet.

(6) All snakebite victims should be taken to the hospital.

(7) If bite is poisonous, and if MEDEVAC is not available, continue the process in para (5) above.

c. Contaminated Water. You should always assume that water found in arid areas is contaminated and treat it properly. Drinking untreated water will result in skin diseases and dysentery, causing excessive water loss. Do not use untested water for washing clothes. Although you can use it for vehicle cooling systems or vehicle decontamination.

d. Sunburn. Sunburn results from overexposing your skin to the sun's rays. So keep your body completely clothed, including gloves on your hands and a scarf around your neck. Use sunburn cream liberally on any exposed areas of skin. Sun poisoning equals nausea and dehydration. In addition, burns may become infected, causing more problems.

Note: Unless otherwise ordered, keep your sleeves rolled down to guard against sunburn.

Remember that:

- There is as much danger of sunburn on cloudy days as on sunny days, especially at high altitudes.
- Sunburn ointment does not give complete protection against excessive exposure.
- Sunbathing or dozing in the desert sun can be fatal.

e. Human Waste Disposal. Proper disposal of human waste is essential. Bury feces and cover urine to prevent attracting flies. If possible, wash hands after defecating or urinating and before each meal. Clean eating and cooking utensils. You must follow good sanitation procedures to lessen the danger of gastrointestinal disorders, which lead to excessive moisture loss.

f. Diseases. Diseases found in the desert include plague, typhus, malaria, dengue fever, dysentery, cholera, and typhoid. Vaccines or prophylactic measures can prevent some of these diseases. Also, high levels of field hygiene and sanitation can prevent disease where there are no vaccines or prophylactic measures.

Vaccines can prevent typhoid and cholera. Fleas and lice carried by rats and other animals, transmit typhus and plague. Proper sanitation and personal cleanliness can help prevent these two diseases. Drinking impure water and eating contaminated foods cause dysentery. Water used for drinking, cooking and bathing must be tested before use. Drink bottled water if available.

g. Fungus Infections and Prickly Heat. The excessive sweating common in hot climates can aggravate prickly heat and some forms of fungus infections of the skin. The higher the humidity the greater the possibility of their occurrence. Although many deserts are not humid, there are exceptions, and these diseases are likely in humid conditions.

h. Respiratory Diseases and Cold Weather Injuries. Soldiers may tend to stay in thin clothing until too late in the desert day and become susceptible to chills, so respiratory infections may be common. Personnel should gradually add layers of clothing at night, (such as sweaters), and gradually remove them in the morning. Where the danger of cold weather injury exists in the desert, commanders must guard against attempts by inexperienced troops to discard cold weather clothing during the heat of the day.

Dust particles that trigger sinus problems and other respiratory ailments, fill the air, even on clear day. It is not practical or feasible to attempt to filter out the dust particles on a daily basis; however, on particularly bad days, personnel do don surgical masks or cover their nose and mouth with a bandanna to reduce the intake.

WARNING

EXPECT A HIGHER-THAN NORMAL INCIDENCE OF RESPIRATORY DISORDERS.

i. Infections from Polluted Water. Polluted water causes skin diseases, so don't use untested water for washing clothes. However, you can use untested water for vehicle cooling systems or vehicle decontamination.

j. Climatic Stress. The glare on the sand causes eyestrain, and wind-blown, fine sand particles can irritate the eyes and cause inflammation. Wear goggles and use eye ointments to protect your eyes. The combination of wind and sand or dust can cause your lips and other exposed skin to chap. Use chapstick and skin ointments to prevent or overcome this problem. The sudden and extreme temperature shifts in arid areas can cause chest colds. Wear warm clothes at night to prevent chills. Desert environments can cause stress to the body and mind. Some stress-rendering factors are:

- Extreme heat during the day with sudden temperature drops in the evening.
- Constantly blowing, sand-laden winds.
- Extensive barren areas, which bring on depression.

Rest is vital in this environment: You need 20 minutes of rest for each hour in the heat and six hours of sleep each day.

PART C - EFFECTS OF CHANGES WITHIN THE ENVIRONMENT, I INCLUDING BATTLEFIELD LIGHT, NOISE AND RANGE ESTIMATION

1. Intensity of Light.

CAUTION

WEAR SUNGLASSES OR GOGGLES IN THE DESERT.

Intense sunlight and heat are present in all arid areas. Air temperature can rise as high as 140 degrees Fahrenheit (60 degrees Centigrade) during the day. As illustrated in Figure 1-12, heat gain results from:

- direct sunlight.
- hot blowing winds.
- reflective heat (the sun's rays bouncing off the sand).
- conductive heat from direct contact with the desert sand and rock.

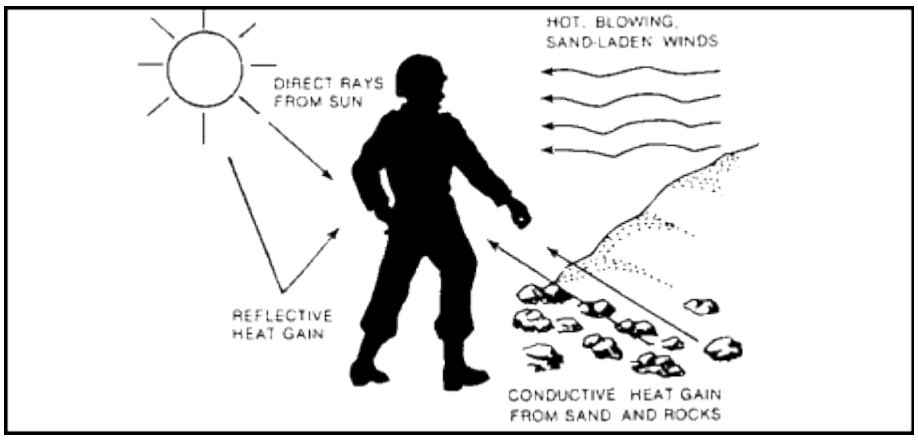

Figure 1-12. Types of heat gain.

Intense sunlight and heat increase the body's need for water. To conserve your body sweat and energy, you need a shelter to reduce your exposure to the heat of the day. Travel at night to minimize the use of water. You can survey the area at dawn, dusk, or by moonlight when there is little likelihood of mirage. Radios and sensitive items of equipment exposed to direct intense sunlight will malfunction.

2. Radiant light.

As seen in Figure 1-13, the sun's rays either direct or bounced off the ground, can affect your skin. Overexposure will cause sunburn. Persons with fair, freckled skin can experience eyestrain and temporarily impaired vision. Skin, such as ruddy complexions, and red hair are more susceptible to sunburn than others. Everyone is susceptible to some degree. Sunburn produces painful reddened skin that can result in blistering and lead to other forms of heat illness.

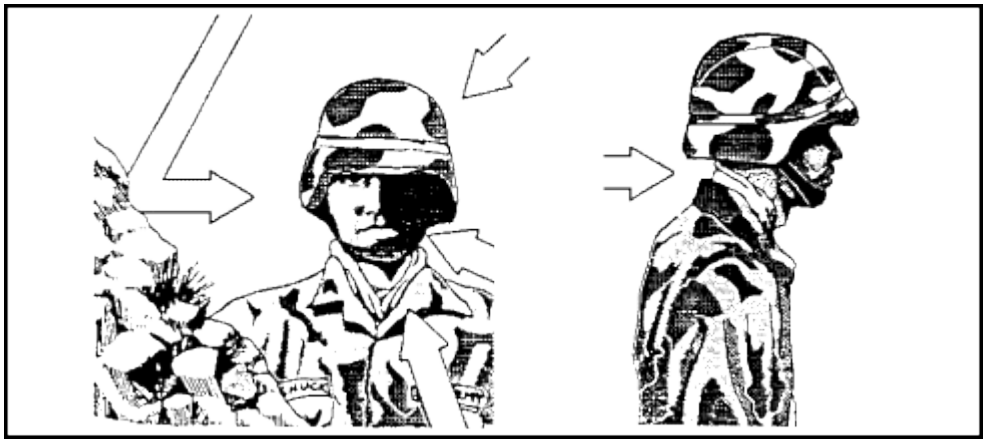

Figure 1-13. Radiant Light From All Directions and Protecting the Back of Your Neck

Soldiers should acquire a suntan in gradual stages, in the early morning or late afternoon, to gain some protection against sunburn. Leaders should not permit their troops to expose bare skin to the sun for longer than five minutes on the first day. Then people can increase exposure gradually at five minutes per day. Stay fully clothed in loose garments in all operational conditions. This also will reduce sweat loss. It is important that you remember that:

- The sun is as dangerous on cloudy days as it is on sunny days.

- Sunburn ointment is not designed to give complete protection against excessive exposure.
- Excessive sunbathing or dozing in the desert sun can be fatal.

Radiant light or its heat effects may be detrimental to plastics, lubricants, pressurized gases, some chemicals, and infrared tracking and guidance systems. You must keep items such as C02 fire extinguishers, M13 decontamination and reimpregnating kits, and Redeye missiles out of constant direct sunlight. Certain optics have discolored under direct sunlight (although this is unusual), so it is wise to minimize their exposure to the sun.

3. Visibility.

As a general rule, a force attacking in daylight should try to have the sun comparatively low and behind it. The assaulting force can see enemy targets plainly without their shadows, while glare, mirages, and haze handicap the defenders. It is not always possible for the sun to be directly behind the attackers and it is not essential. To rely on this leads to a stereotyped method of attack, which would become known to the defenders. As shown in Figure 1-14, the commander of a maneuver force should attempt to keep the sun somewhere on a 3,200-mil arc to his flanks or rear, giving a wide choice of angle of attack.

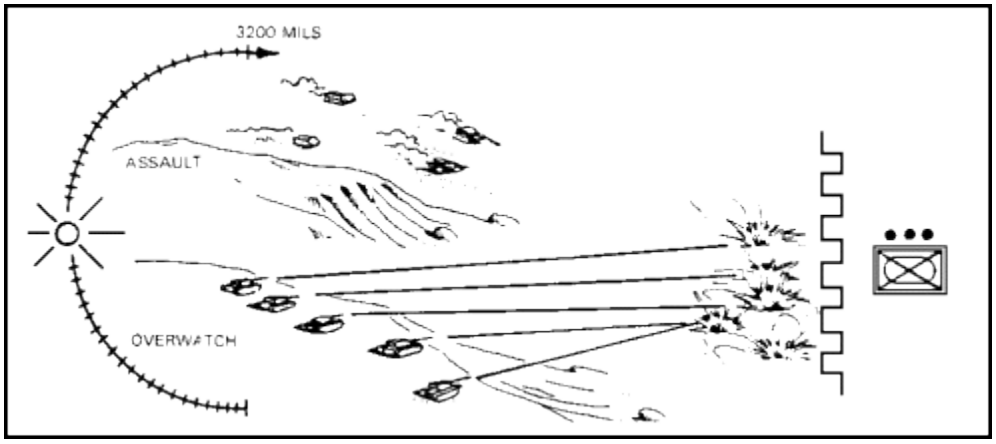

Figure 1-14. Attack from the Sun.

A powerful sun and low cloud density combine to produce unusually bright and glaring light conditions during the day. In certain circumstances, light allows such unlimited visibility that gross underestimation of distance is common. Visibility may be degraded by mirages or heat shimmer caused by heated air rising from the extremely hot desert surface. This happens when the observer is looking into the sun or through magnifying optical instruments. (Note the effects of the mirage in Figure 1-17.)

Because mirages distort the shape of objects, particularly in the vertical dimension, observation is best at dawn and dusk when the air is cooler. Positions selected for observation posts should be as high above the desert floor as possible. Vision with night observation devices and even with the naked eye is exceptionally good on moonlit nights.

NOTE: A good way to measure distance is to use your vehicle odometer.

4. Levels of light.

Light levels in desert areas are more intense than in other geographic areas. Moonlit nights are usually crystal clear; winds die down, haze and glare disappear, and visibility is good. You can see lights, red

flashlights, and blackout lights great distances away. Noise carries far. Conversely, during nights with little moonlight, visibility is extremely poor. Travelling is extremely hazardous; you must take care to avoid

- getting lost.
- falling into ravines.
- stumbling into enemy positions.

Movement during such a night is practical only if you have a compass and have spent the day in shelter, resting, observing and memorizing the terrain, and selecting your route.

5. Darkness.

Many offensive operations take place at night. Observation in these conditions varies according to the amount of ambient light. A near full moon and the clear desert sky allow for good observation, both with the naked eye and with night observation devices. Maneuvering units using night vision devices must continually scan the surrounding terrain to pick up enemy activity that would be acquired by peripheral vision in daylight.

When there is no moon or very little moon, the desert night is extremely dark. Under these conditions, passive vision devices (except for thermal imagery) are of little value. You will have to rely on active light sources. However, to maintain surprise in an operation, headquarters must strictly control the employment of artificial light. As a general rule, direct-fire weapons with muzzle-blast debris-kickup should not illuminate their target themselves. Following contact, when some targets should be on fire, you can use passive devices.

6. Prepositioned lights.

This method places two or more searchlights far apart, as shown in Figure 1-15. They are behind the line of contact, beyond enemy artillery range, and concealed from enemy ground observation. Area units determine their locations by resection, using the vertical beams of the lights. Enemy air threats may require the lights to be well away from friendly units. Move the lights on a time schedule known to each unit.

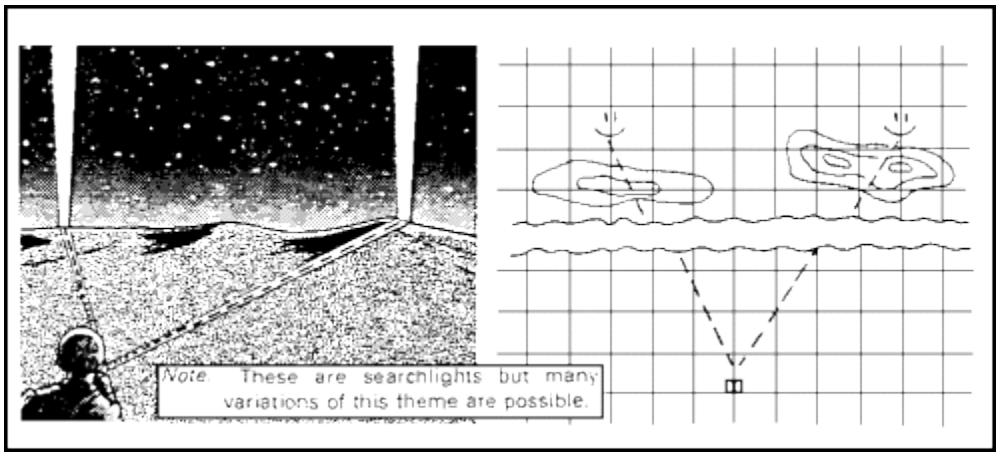

Figure 1-15. Using Resection on the Vertical Beams of Prepositioned Lights.

7. Light and noise.

Light and noise at night may be seen or heard from miles away, so strict light and noise discipline is necessary. Enemy passive night vision devices can pick up light sources of any color at greater ranges than the unaided eye. One momentary lapse may be enough to attract enemy attention and permit enemy resection. Muffle and keep to the minimum essential noise such as those produced by generator motors. Units should start all engines together. This will confuse the enemy as to the number and direction of the vehicles. Do not use lights inside any vehicle unless there is no possibility of leakage. Equipped command vehicles come with automatic door switches and blackout vestibules. If you must use external lights for any purpose, they should be dark blue or dark green and capable of being dimmed by rheostats. Permanently cover items such as brake lights. Figure 1-16 illustrates this problem.

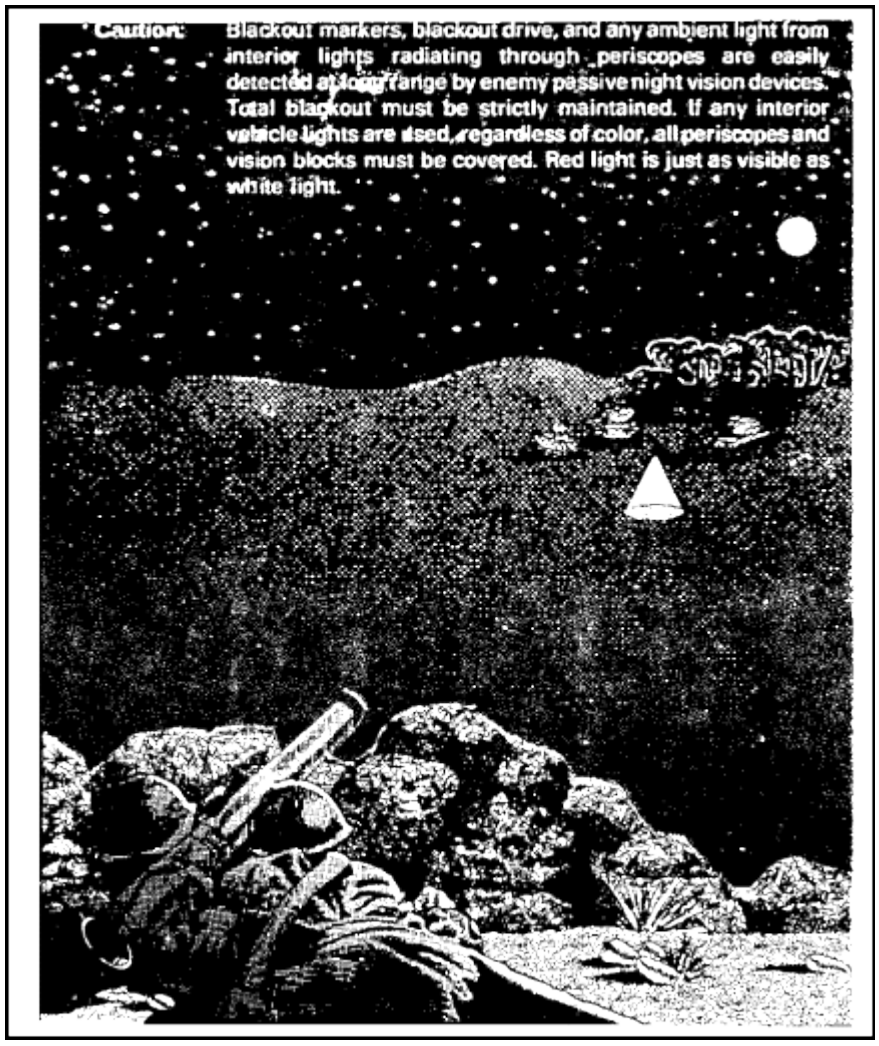

Figure 1-16. Camouflage Light and Noise at Night.

8. Noise.

Psychological Operations units may use noise to create a false impression of strength or movement, or to lure an enemy force into an area where fires can be concentrated against them. Noise, particularly effective at night, carries far, but it is affected by wind strength and direction. Noise may be recorded. A

line of powerful tape recorders can easily simulate a column of tanks or helicopters on the move. However, you can produce a situation different than that intended. It is essential that the amplifier hum is not heard. Deliberate natural noise, for example, the clang of dropped cans or a closing tank hatch, can easily be overdone by constant repetition.

9. Dust.

The normal dust column raised by movement can be used to an advantage. You can make a fake helicopter landing zone more realistic with decoy aircraft and a jeep towing chains between the "aircraft," giving the impression of aircraft hovering close to the ground. A few real aircraft flying Nap of the Earth (NOE) can give the impression of a great deal of activity.

Dust is an observation hazard to a maneuvering force, especially in situations of little or no wind. Teams should move in levels with "bounding" overwatching elements on the upwind side. Observers and attack helicopters must operate well to the flank. Since it is impossible to disguise daylight movement, the assault should be as rapid as possible to minimize enemy reaction time.

10. Range observation at great distances.

A person standing on a hill 300 meters high can see, depending on the landscape, for 20 or 30 km on a clear day. Land that looks flat from the hill actually has two ridgelines in that distance. The uniform color of the land and the even lighting at midday make it difficult to distinguish changes in elevation at great distances. The effect is similar at near range. Soldiers frequently aim at an enemy vehicle with a recoilless rifle without noticing the stretch of low ground in between. The round falls short. It is not a question of carelessness, but of an optical illusion that affects range estimation and targeting.

The casual observer will frequently miss intermediate features in the landscape. An observer must think about what he sees, and look for the unexpected. (Such problems in observation decrease at dawn and dusk, when shadows define terrain features.)

Mirages and Haze. Figure 1-17 shows an optical phenomena caused by the refraction of light through heated air rising from a sandy or stony surface. They occur in the interior of the desert about six miles (9.6 kilometers) from the coast. They make objects that are one mile (1.6 kilometers) or more away appear to move. This mirage effect makes it difficult for you to identify an object from a distance. It also blurs distant range contours so much that you feel as if you are surrounded by a sheet of water from which elevations stand out as "islands." The mirage effect makes it hard for a person to identify targets, estimate range, and spot personnel. However, if you can get to high ground (ten feet or more above the desert floor), you can get above the super-heated air close to the ground and overcome the mirage effect. Mirages make land navigation difficult because they obscure natural features.

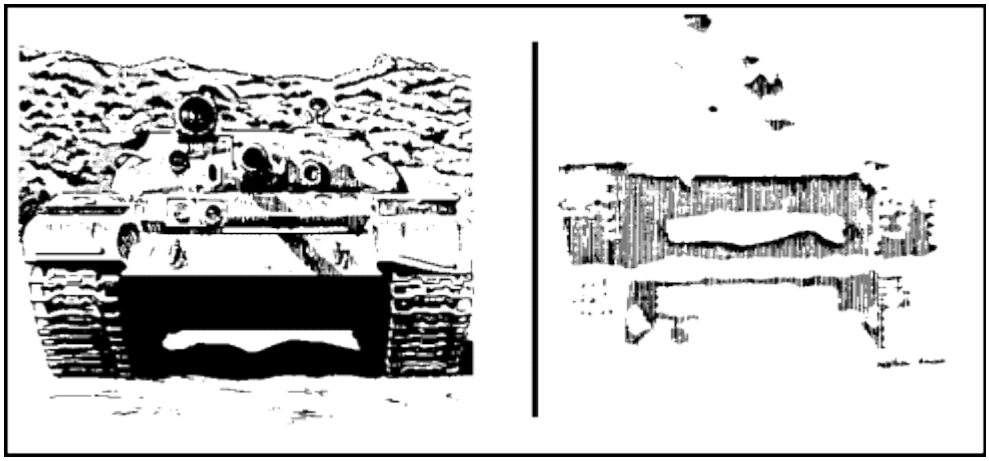

Figure 1-17. Close-up (left) and Effects of Mirage (right).

In some circumstances camouflaged equipment or positions less than a meter from the ground are invisible to about 2,000 meters. Moreover, mirages allow observation of objects below the horizon. Although these effects may be distorted, enlarged, or fuzzy and unrecognizable, they depend entirely on the angle of the sun to the observer and are best combated by:

- Maintaining observers as high above the desert floor as possible, even if only in tanks hull-down behind the tops of sand dunes.
- Observation over a wide area by vehicle crews. This may allow a vehicle on one side of a position to warn one on the other side of a possible threat to his front.

LESSON 1
PRACTICE EXERCISE

Instructions The following items will test your understanding of the material covered in this lesson. There is only one correct answer for each item. When you have completed the exercise, check your answers with the answer key that follows. If you answer any item incorrectly, review that part of the lesson which contains the portion involved.

Situation: You are a mechanized infantry officer who must prepare your troops and equipment for desert operations somewhere in the Middle East. You and most of the soldiers under your command are inexperienced in desert operations and will require several weeks of desert training prior to departure overseas in accordance with METT-T (Mission, Enemy, Terrain, Troops and Time Available). Desert training will take place in the Southwestern United States where the extremely arid terrain includes mountains, rocky plateaus, sand dunes, salt marshes and dissected terrain.

1. According to a situation map of the training area, you are about to enter a rocky plateau area interspersed with flat areas and sand dunes. Your best movement plan would be to

   - ○ A. travel only at night to avoid being sighted by the enemy.
   - ○ B. travel only at night or early morning when the sand is damp and traction is better.
   - ○ C. travel day or night but keep to the outer perimeter of the sand dunes and flat areas.
   - ○ D. travel during the day through the rocky plateau, which may offer water, shade, and concealment.

2. You have a training mission to capture an airfield in a poorly mapped sand-dune area. Although neutralized by air power, you must drive there through sand dunes. A careful route reconnaissance has been made. Before entering the sand, you first command your drivers to

   - ○ A. select a gear that will allow the vehicles to maintain torque without wheel spin and to minimize changing gears.
   - ○ B. maintain momentum if sand builds up between rear sprockets and treads.
   - ○ C. use four-wheel drive only after a vehicle bogs down.
   - ○ D. climb the crust of a downwind side of a dune and halt at the crest to check the angle on foot.

3. During your desert training, you learn about arid-area vegetation and wildlife that

   - ○ A. like rodents, you conserve your moisture by halting at mid-day for a designated sleeping area away from the direct heat of the sun.
   - ○ B. some troops wake up after their first night with a case of agoraphobia, although bugs and snakes are dormant at night.
   - ○ C. you have no difficulty finding shelter and camouflaging in areas that have a water table within one meter.
   - ○ D. for best protection against chemical attack, your troops should sleep directly on the ground dispersed away from large vehicles that may be targets.

4. When issuing your operation order, an important consideration to mention is

   - ○ A. ground transportation should stick to only well-maintained roads and trails.
   - ○ B. structures or ruins are to be avoided as defensive positions.
   - ○ C. avoid contact with high-mineral or high-salt content soil or even water for wetting your uniform to cool off.
   - ○ D. tracked vehicles should use irrigation canals for evasion and to prevent getting lost.

5. Your men are engaged in light activity in 79 degree WBGT (slightly less than 105 degrees fahrenheit) temperature. To prevent heat illness in your command, you ensure your troops

   - ○ A. acclimatize by progressively reducing their water intake.
   - ○ B. condition themselves to stop sweating when exercising during periods of high air temperature.
   - ○ C. drink only when thirsty or when suffering water depletion symptoms of fatigue, cramps or vomiting.
   - ○ D. drink at least six quarts of water per man per day.

6. After desert training is complete, you know your troops will experience jet lag upon arrival in the Middle East and will require some after flight recovery time. Ideally, you would allow your troops a recovery time of

   - ○ A. one hour for every time zone crossed.
   - ○ B. eight hours for every time zone crossed.
   - ○ C. one day for every time zone crossed.
   - ○ D. two or three days maximum.

7. After you arrive in the Middle East, one of the first things you notice when you step off the aircraft is how hot it is. You can find relief from heat gain with all three of these factors EXCEPT

   - A. controlling hot, blowing sand-laden winds.
   - B. avoiding conductive heat from direct contact with the desert sand and rock.
   - C. getting started on acquiring as much of a suntan as possible the first day.
   - D. shielding the reflective heat of the sun's rays bouncing off the sand.

8. The DMZ generally runs from the north to the south, and you are on the west. You must be particularly alert to a

   - A. mid-day chemical attack with the sun dangerously exposing M5 impregnating kits.
   - B. night infiltration when your defense is handicapped by the extremely poor range of light.
   - C. prepositioned searchlight rotating in the west.
   - D. morning attack with the sun comparatively low and behind the enemy.

9. You decide to convoy at night to minimize the use of water. An important consideration about desert operations at night is

   - A. units should start their engines at 30-second intervals for psychological effect.
   - B. red filters must be put over lights to prevent detection by enemy passive night-vision devices.
   - C. light and noise can be seen or heard from miles away.
   - D. drivers are prone to the optical illusion of refracted light obscuring a vehicle on bounding overwatch.

10. You drive over a ridge and come upon a uniformly-colored open area of several miles. There appears to be a large lake with scattered islands. On one island you see a row of enemy vehicles that appear to be moving. You take aim with mortars and artillery. Chances are someone ignorant of desert effects would have a range estimation that causes rounds to

    - A. fall short because of optical illusion.
    - B. fall behind the target because bodies of water look farther away.
    - C. have a tightly-grouped pattern after any mirage effect is overcome by getting to low ground.
    - D. hit the target with greater accuracy when terrain features are more visible around mid-day.

PRACTICE EXERCISE

ANSWER KEY AND FEEDBACK

Situation: You are a mechanized infantry officer who must prepare your troops and equipment for desert operations somewhere in the Middle East. You and most of the soldiers under your command are inexperienced in desert operations and will require several weeks of desert training prior to departure overseas in accordance with METT-T (Mission, Enemy, Terrain, Troops and Time Available). Desert training will take place in the Southwestern United States where the extremely arid terrain includes mountains, rocky plateaus, sand dunes, salt marshes and dissected terrain.

1. According to a situation map of the training area, you are about to enter a rocky plateau area interspersed with flat areas and sand dunes. Your best movement plan would be to
   A. travel only at night to avoid being sighted by the enemy.
   B. travel only at night or early morning when the sand is damp and traction is better.
   C. travel day or night but keep to the outer perimeter of the sand dunes and flat areas.
   D. travel during the day through the rocky plateau, which may offer water, shade, and concealment.

      The rocky plateau may offer sources of water, as well as cover and concealment. Although you should avoid travel through sand dunes, they are not as prone to flash flooding. Movement at night is dangerous in mountain and rocky plateau areas.

2. You have a training mission to capture an airfield in a poorly mapped sand-dune area. Although neutralized by air power, you must drive there through sand dunes. A careful route reconnaissance has been made. Before entering the sand, you first command your drivers to
   A. select a gear that will allow the vehicles to maintain torque without wheel spin and to minimize changing gears.

      A sandy desert may be nearly flat or broken up by dunes. The best time to drive on sand is at night or early morning when the sand is damp and traction is better. A surface crust, caused by chemicals cementing sand particles together, covers some areas. In some cases, it is possible to drive on this crust to keep the dust down. Use the following techniques when driving in sand.

         (1) Before entering sand, you should select a gear that will allow the vehicle to keep as much torque as possible without causing the wheels to spin and to minimize changing gears.

         (2) A lack of steering response in a tracked vehicle indicates that sand is building up between the rear sprockets and the treads. If you allow this to continue, the sand will build up and force the track off. You can throw the sand off by "shaking" the vehicle with the steering or by backing up. You must evenly distribute vehicle loads and use rear-wheel drive where necessary to avoid digging in the front wheels. Drivers should switch to all-

wheel drive or change gears before a vehicle becomes bogged down.

B. maintain momentum if sand builds up between rear sprockets and treads.

C. use four-wheel drive only after a vehicle bogs down.

D. climb the crust of a downwind side of a dune and halt at the crest to check the angle on foot.

3. During your desert training, you learn about arid-area vegetation and wildlife that

A. like rodents, you conserve your moisture by halting at mid-day for a designated sleeping area away from the direct heat of the sun.

Smaller animals like rodents conserve their moisture at daytime by burrowing underground away from the direct heat of the sun. Available vegetation is inadequate for much shade, shelter, or concealment, especially from the air. This may induce temporary agoraphobia (fear of open spaces) for some soldiers new to desert conditions. It usually disappears with acclimatization. The desert has few areas such as trees to protect large vehicles. You should sleep in your vehicle during short halts. For more than an hour, designate a sleeping area with a protective perimeter. Always let someone know where you plan to sleep. Use ground guides when moving vehicles into an area where troops might be sleeping. Sleep on a cot above the ground. The ground is hotter than the air above it. Also, snakes, spiders, and scorpions don't get to you so easily if you're on a cot.

B. some troops wake up after their first night with a case of agoraphobia, although bugs and snakes are dormant at night.

C. you have no difficulty finding shelter and camouflaging in areas that have a water table within one meter.

D. for best protection against chemical attack, your troops should sleep directly on the ground dispersed away from large vehicles that may be targets.

4. When issuing your operation order, an important considerationto mention is

A. ground transportation should stick to only well-maintained roads and trails.

B. structures or ruins are to be avoided as defensive positions.

C. avoid contact with high-mineral or high-salt content soil or even water for wetting your uniform to cool off.

Arid regions have areas of surface soil with high mineral content (borax, salt, alkali, and lime). Material contacting this soil wears out quickly, and the water is very hard and undrinkable. You may get a skin rash by wetting your uniform in such water to cool off. You cannot tell your people to stick to roads and trails, since they are scarce in the open desert. You may find only simple commercial links. Some surfaces, such as lava beds or salt marsh, may preclude any routine vehicular movement. Yet ground transportation often can travel in any direction.

You may need to make defensive positions of the ruins of earlier civilizations that are scattered across the deserts. You may find ancient posts and forts which invariably command important avenues of approach or dominate the only available passes in difficult terrain. Irrigation canals can be an effective tank obstacle and may limit surface mobility. However, you must consider the effect of destruction of an irrigation system on the local population in an operation estimate.

D. tracked vehicles should use irrigation canals for evasion and to prevent getting lost.

5. Your men are engaged in light activity in 79 degree WBGT (slightly less than 105 degrees Fahrenheit) temperature. To prevent heat illness in your command, you ensure your troops
   A. acclimatize by progressively reducing their water intake.
   B. condition themselves to stop sweating when exercising during periods of high air temperature.
   C. drink only when thirsty or when suffering water depletion symptoms of fatigue, cramps or vomiting.
   D. drink at least six quarts of water per man per day.

   An important water requirements guide, based on 80 degrees WBGT, suggests six quarts per man per day for light activity such as deskwork, guard duty or radio operating. Once the U.S. Army and the Israeli Defense Forces tried to condition men by progressively reducing their water supplies during training. This "water discipline" caused hundreds of heat casualties. Remember, you can't drink too much water! The more you sweat, the more moisture you lose. Sweating is the main cause of water loss. You will have a heat stroke if you stop sweating during high air temperatures or heavy exercise. It is an emergency requiring immediate medical attention. Thirst is not a reliable guide for your water needs. Thirst as a guide will cause you to drink only two-thirds of your daily requirement.

6. After desert training is complete, you know your troops will experience jet lag upon arrival in the Middle East and will require some after flight recovery time. Ideally, you would allow your troops a recovery time of
   A. one hour for every time zone crossed.
   B. eight hours for every time zone crossed.
   C. one day for every time zone crossed.

   Jet lag affects eating and sleeping habits, mental agility, and general attitude. Jet lag should be seriously considered when beginning desert operations after traveling from a great distance. You should allow a recovery period, ideally, of one day for every time zone crossed. Climatic stress of sudden and extreme temperature shifts in arid areas can cause chest colds. Wear warm clothes at night to prevent chills. A disease such as plague, typhus, malaria, dengue fever, dysentery, cholera, and typhoid is found in the desert. Some can be prevented by vaccines or prophylactic measures. You need high levels of field hygiene and

sanitation where there are no vaccines or prophylactic measures. You should check the color of your urine; a light color means you are drinking enough water; a dark color means you need to drink more.

D. two or three days maximum.

7. After you arrive in the Middle East, one of the first things you notice when you step off the aircraft is how hot it is. You can find relief from heat gain with all three of these factors EXCEPT

A. controlling hot, blowing sand-laden winds.

B. avoiding conductive heat from direct contact with the desert sand and rock.

C. getting started on acquiring as much of a suntan as possible the first day.

You should acquire a suntan in gradual stages, in the early morning or late afternoon. This gives some protection against sunburn. On the first day, leaders should not permit troops to expose bare skin to the sun for longer than five minutes. Then you can increase exposure gradually at the rate of five minutes per day. In all operational conditions your people should be fully clothed in loose garments. This also reduces sweat loss. You will notice intense sunlight and heat when stepping off the plane. The air temperaturecan get as high as 140 degrees Fahrenheit (60 degrees Centigrade) during the day. You need to shield from direct sunlight, hot blowing winds, reflective heat (the sun's rays bouncing off the sand), and conductive heat from direct contact with the desert sand and rock. Don't sit out on an open runway!

D. shielding the reflective heat of the sun's rays bouncing off the sand.

8. The DMZ generally runs from the north to the south, and you are on the west. You must be particularly alert to a

A. mid-day chemical attack with the sun dangerously exposing M5 impregnating kits.

B. night infiltration when your defense is handicapped by the extremely poor range of light.

C. prepositioned searchlight rotating in the west.

D. morning attack with the sun comparatively low and behind the enemy.

An assaulting force should try to have the sun low and behind. The attacker sees enemy targets plainly, while defenders are handicapped by glare, mirages, and haze. You must keep out of constant direct sunlight items such as C02 fire extinguishers, M13 decontamination and reimpregnating kits, and Redeye missiles. Light levels are more intense. Moonlit nights are crystal clear. When winds die down, haze and glare disappear, and visibility is good. You can see lights, red flashlights, and blackout lights at great distances. Also, noise carries far. A prepositioned searchlight is placed far apart from another searchlight. They are beyond enemy artillery range, and concealed from enemy ground observation. Units can determine their locations by resection, using the vertical beams of the

lights.

9. You decide to convoy at night to minimize the use of water. An important consideration about desert operations at night is
   A. units should start their engines at 30-second intervals for psychological effect.
   B. red filters must be put over lights to prevent detection by enemy passive night-vision devices.
   C. light and noise can be seen or heard from miles away.

      Because of this, you need strict light and noise discipline. Enemy passive night vision devices can pick up light sources at greater ranges than the unaided eye. Units should start all engines together. This confuses the enemy on the number and direction of vehicles. External lights, if you must use them, should be dark blue or dark green and capable of being dimmed by rheostats. Permanently cover items such as brake lights. When dust is an observation hazard to a maneuvering force, teams should move in levels with "bounding" overwatching elements on the upwind side.

   D. drivers are prone to the optical illusion of refracted light obscuring a vehicle on bounding overwatch.
10. You drive over a ridge and come upon a uniformly-colored open area of several miles. There appears to be a large lake with scattered islands. On one island you see a row of enemy vehicles that appear to be moving. You take aim with mortars and artillery. Chances are someone ignorant of desert effects would have a range estimation that causes rounds to
    A. fall short because of optical illusion.

       A uniform color of the land and even lighting at midday can make it difficult to distinguish changes in elevation. Soldiers may aim with a recoilless rifle without noticing the stretch of low ground in between. The round falls short, because of optical illusion . An observer may miss intermediate features in the landscape, and must think about what he sees, and look for the unexpected. (Such problems decrease at dawn and dusk, when shadows define terrain features.) The mirage effect makes objects appear to move. It also blurs distant range contours such that it seems like you are surrounded by a sheet of water from which elevations stand out as "islands." The mirage effect makes it hard to identify targets, estimate range, and spot personnel. However, on high ground, you are above the super-heated air close to the ground and overcome the mirage effect.

    B. fall behind the target because bodies of water look farther away.
    C. have a tightly-grouped pattern after any mirage effect is overcome by getting to low ground.
    D. hit the target with greater accuracy when terrain features are more visible around mid-day.

LESSON TWO

DESERT CAMOUFLAGING, WEAPONS MAINTENANCE, ENVIRONMENTAL EFFECTS ON PERSONNEL AND EQUIPMENT AND PREPARATIONS FOR DESERT OPERATIONS

OVERVIEW

TASK DESCRIPTION:

In this lesson, you will learn how to determine and select methods, techniques, and procedures used in camouflaging self and equipment in a desert environment to include protection of eyes and skin from overexposure during extreme heat, protection from the sun during daylight hours, and how to construct a field-expedient shelter in the desert. You also will learn to demonstrate supervisory skills in directing and supervising weapons maintenance in a desert environment, and to identify and select the desert's environmental effects on personnel and equipment. Also, you will learn to determine and select factors and considerations needed in preparing for desert operations.

LEARNING OBJECTIVE:

TASKS:	Determine and select methods, techniques, and procedures used in camouflaging self and equipment in a desert environment, including protection of eyes and skin from overexposure during extreme heat, protection from the sun during daylight hours, and the construction of a field-expedient shelter. Direct and supervise weapons maintenance in a desert environment. Identify and select the desert's environmental effects on personnel and equipment. Determine and select factors and considerations for preparation of desert operations.
CONDITIONS:	You will have information from FM 90-3, FM 21-76 and Newsletter No. 90-7, Special Edition, AUG 90.
STANDARDS:	Determine and select methods, techniques, and procedures for camouflaging self and equipment in a desert environment, including protection of eyes and skin from overexposure during extreme heat, and from the sun during daylight hours, construct a field-expedient shelter, direct and supervise weapons maintenance in a desert environment, identify and select the desert's environmental effects on personnel and equipment, and determine and select factors and considerations for preparation of desert operations in accordance with FM 90-3, FM 21-76 and Newsletter No. 90-7, Special Edition, AUG 90.
REFERENCES:	The material contained in this lesson was derived from the following publications: FM 90-3 FM 21-76 Newsletter No. 90-7, Special Edition, AUG 90.

INTRODUCTION

There are many problems associated with living and fighting in the desert environment. Throughout history, the Greek, French, British, and American forces have learned and relearned the problems

associated with desert operations. More recently, observations gathered after the Arab-Israeli conflict of the 60's and 70's have provided lessons learned on personnel, operations, and equipment in the desert. Desert conditions can force our military to reevaluate and rethink operational plans. History and lessons learned will have an impact on how the U. S. Army performs in the future. Safety, survival, study, and common sense thinking will lead to mission accomplishment.

Many insights for both active and reserve component units come from the National Training Center (NTC), Exercise Bright Star, Saudi Arabia Lessons Learned (Army Materiel Command, 1983), and information extracted from the Center for Army Lessons Learned (CALL) data base. Remember that the principles and fundamentals of combat do not change in the desert. Priorities may alter and techniques will vary from those in temperate climates. However, soldiers, leaders, and units who are fit and well trained to fight in other environments will have little difficulty adjusting to desert war. We have been training at the NTC since 1982, and, as shown by Desert Storm, know how to fight in the desert.

PART A - CAMOUFLAGING SELF AND EQUIPMENT IN A DESERT ENVIRONMENT

1. Desert Shelters.

In an arid environment, you must consider time, effort, and material needed to make a shelter. If you have canvas, parachute, poncho, or aircraft soundproofing materiel, use it and a terrain feature as follows:

a. Rock Method:

- Find an outcropped rock.
- Anchor one end of your material on the edge of the outcropped rock using rocks or other weights.
- Extend and anchor the other end of the material so it gives you the best possible shade.

b. Mound Method:

- Build a mound of sand or use the side of a sand dune for one side of the shelter.
- Anchor one end of the material on top of the mound (or sand dune) using sand or other weights.
- Extend and anchor the other end of the material so it gives you the best possible shade.

NOTE: If you have enough material, fold it in half and form a 12 to 18-inch (30 to 45-centimeter) airspace between the halves. This will reduce the temperature below the shelter.

c. Below Ground Method. This type shelter, shown in Figure 2-1, reduces the midday heat as much as 30 to 40 degrees Fahrenheit. Building it, however, requires more time and effort than building other types of shelters. During the day, your physical effort will make you sweat more, increasing dehydration. Thus, you should wait until the cool of the night to make it.

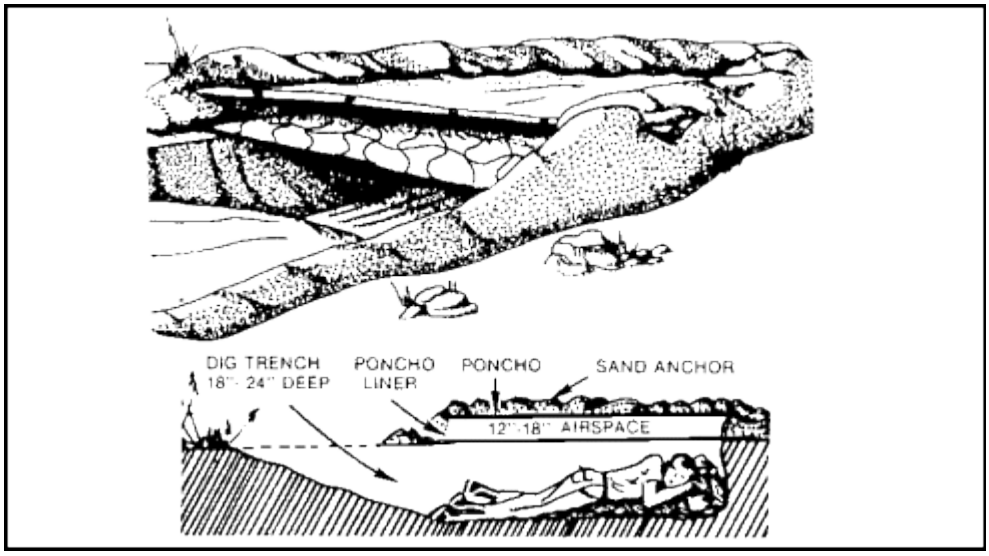

Figure 2-1. Desert Shelter.

To make this shelter:

- Find a low spot or depression between dunes or rocks. If necessary, dig a trench 18 to 24 inches (45 to 60 centimeters) deep and long enough and wide enough for you to lie down comfortably.
- Pile the sand you take from the trench around three sides to form a mound.
- Dig out more sand on the open end of the trench so you can get in and out of your shelter easily.
- Cover the trench with material, such as parachute, poncho, or canvas.
- Secure the material in place using sand, rocks, or other weights.

If you have extra material, you can further decrease the midday temperature in the trench by securing the material 12 to 18 inches (30 to 45 centimeters) above the other cover. This layering of material will reduce the inside temperature 20 to 40 degrees Fahrenheit.

2. Cover and Concealment.

This paragraph describes the influence of the environment on cover and concealment and certain techniques you can use in the desert.

a. Cover. When moving in a desert lacking heavy vegetation or man-made objects, obtain cover by terrain masking. When digging in positions for tanks and personnel carriers, make irregular-shaped scoops about two meters deep in the center and three times the vehicle width in approximate diameter. These more closely resemble natural depressions in the desert floor. If the ground is extremely rocky and engineer assistance is not available, it may be necessary to build sangars for dismounted infantry. As shown in Figure 2-2, use the largest rocks available to make sangars. Securely wedge the rocks together with a one-foot (. 3 meter) slope on each side for each four feet (1. 22 meters) in height. Line the sangar walls with sandbags. Sangars must be as small as possible in diameter, holding three or four men each.

Figure 2-2. Sangar.

b. Concealment. You rarely can achieve total concealment of an object, but camouflage properly used can make it impossible to perceive what the object is.

(1) Movement. Any form of desert movement creates dust. Moving directly across country on the hardest ground available reduces dust clouds. Many desert surfaces are thin hard crusts with dust underneath, and the crusts are easily broken. In this case and to prevent dust signatures, vehicles should not directly follow each other unless there is a serious danger of mines. When planning for employment of attack helicopters, consider that helicopters may have to operate higher than normal to avoid noticeable dust signatures.

(2) Shape. The problem of shape is the same as in temperate climates. However, excellent observation and lack of concealment in desert terrain make it more difficult. You can shape a certain amount by covering vehicles with scrub held on with chicken wire. Try to harmonize with the background using this technique. Gasoline and water trucks, usually prime targets for enemy attack, should have canvas covers over their bodies so they resemble standard cargo trucks. Desert camouflage nets must match the color and texture of the ground and must also be complete covers. A standard net, which relies on casting irregular shadows, is useless in this terrain. Avoid antenna farms at command posts by remoting radios in different directions from the TOC.

(3) Shine. Avoid shine on vehicles and equipment by using matte camouflage paint, covered, if necessary, by mud or a thin mixture of grease and sand. For aircraft, this mixture is unsuitable. Therefore, they must rely on paint alone. You may cover vehicle windshields with cloth, thin enough to allow vision through it. Cover all aircraft optical devices when not in use, even at night. As shown in Figure 2-3, keep shading over optics such as gunsights and binoculars. Use with caution such shiny items as mapboards and mess kits.

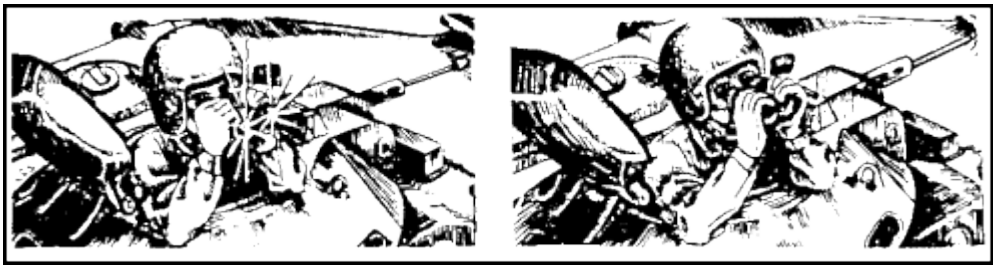

Figure 2-3. Shade Optics to Prevent Shine.

(4) Shadow. Because there is little vegetation in most deserts, strong shadows, are readily observed from the air. Note the effect shown in Figure 2-4. You can disrupt shadows by

- altering the equipment shape.
- using the correct angle to the sun to reduce shadow size.
- causing shadows to fall on broken ground or vegetation whenever possible.

The best solution is to dig in, and use overhead cover or, at least, camouflage nets. It is also necessary for you to move vehicles and equipment as the sun moves.

Figure 2-4. Camouflage: Effect of Shadow.

(5) Heat. A thermal sensor is a passive device that can build up a picture of a target. It can penetrate limited camouflage and smoke screens as heat has greater penetrating power than light. It relies on temperature differences between a target and its surroundings; the greater the difference the better the resolution. It should not be as efficient in the desert day as it would be at the same hour in cooler climates. However, it will be very useful at night. So it is particularly necessary to shield heat emission sources at night. Figure 2-5 shows the thermal image of a tank at night. Note the tracks, roadwheels, commander, and driver. This tank has not fired recently, so there is no special radiation from the tube.

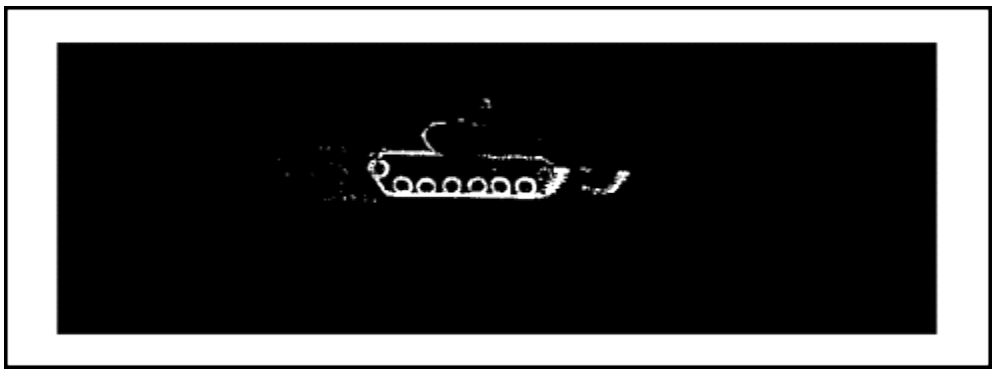

Figure 2-5. Thermal Image of Tank at Night.

(6) Smoke. To conceal movement, it is often necessary to use smoke in large quantities, both day and night. Smoke does not provide total protection. It only degrades the enemy's close observation capabilities. Smoke does not affect radar significantly. Thus, enemy radar can see troops and aircraft operating behind smoke. Thermal imagery also can see through smoke. Although, the higher the ambient temperature the less effective this will be.

Desert weather to some degree affects smoke. Turbulent air conditions at maximum temperatures for example, may cause white phosphorus to pillar and break up rapidly. A steady wind about five knots across the target in the lower temperatures of morning and evening is the best condition for a deliberate screen.

There are four general categories of smoke employment in desert warfare:

(a) Large-area Smoke Screen. Normally, a large-area smoke screen is preplanned (as it often requires prestocking of ammunition) and fired by field artillery or mortars. Use smoke generators, especially when crossing obstacles. A screen of great density, width, and duration will probably alert the enemy that movement is in progress. However, you also can use large-area smoke screens in a deception plan.

(b) Small-area Smoke Screen. Normally, you lay down a small-area smoke screen by battalion task force mortars or tank guns. This type of screen will be the most common employment of smoke in the desert. Commanders should consider carrying more smoke ammunition in mortar platoons and company headquarters tanks than would be normal in temperate climates.

(c) Identifying Smoke. A forward observer or other person directing artillery fire may use smoke to identify ranging rounds when they strike. This is particularly the case where significant terrain features are absent. It is also useful to mark targets for close air support.

(d) Local Smoke. A tank fires local smoke when caught in the open by enemy fire. Sometimes it will be the first indication to an overwatch element that the enemy is firing. The tank commander uses smoke to conceal his movement to a

hull down position while overwatch vehicles engage the enemy. Commanders must guard against any tendency to allow an attack to lose momentum by overuse of local smoke.

3. Equipment Camouflaging.

a. Vehicles and Aircraft. Movement of vehicles produces dust, diesel plumes, and distinctive track marks. The slower the speed the less the dust. However, you must balance the need for speed against the dust that may be produced. Drivers must avoid harsh use of accelerators, the main cause of diesel plumes.

After dismounting local security, camouflage is the first priority when a vehicle halts. Actions to be taken are:

- Position vehicle in vegetation or shadow if available.
- Cover shiny surfaces and shadow areas with burlap screens.
- Drape net.
- Add any available vegetation to net.
- Blot out vehicle tracks for 50 meters behind vehicle.

During the day, you may have a problem with shine from the following:

- Optical instruments (which you should keep shaded).
- Matte paint polished by continual wear.
- Tracks, particularly if the rubber blocks have been removed.

When stationary, use burlap to cover running gear on tracks polished by wear.

b. Position Selection. Position selection is critical, at every level. One essential of camouflage, particularly in the desert, is to fit into the existing ground pattern with minimum alteration to terrain. For example, you can improve a wadi bottom with vegetation or a pile of boulders by using grey burlap and chicken wire. Do not choose sites that are virtually automatic targets for enemy suppressive fires. If possible, screen antennas against the enemy. Use existing trails and blend new trails into old ones.

Shadows, particularly in the morning and evening, identify objects. Place equipment in total shadow (rarely found) or with its maximum vertical area towards the sun so minimum shadow falls on the ground. For example, the maximum vertical area on a five-ton truck with canopy, is the rear. For an M88, its the front. You can break shadow up by taking positions next to scrub or broken surfaces such as rocks. Do not site equipment broadside to the sun. Moving equipment as the sun moves, is usually necessary. Digging-in reduces the length of shadows.

c. Ground Surface. Vehicles passing over pebble or heavy ground surface press the pebbles or gravel into the soil. This causes track marks to be prominent when viewed from the air. Avoid such areas if possible. Soil texture suitable for digging must be a consideration when

reconnoitering for battle positions. You must cover holes to avoid cast shadows. You should dig trenches for vehicles that will be in position for more than a day.

d. Dispersion and Discipline. You can easily detect vehicles bunched together in open areas at ranges up to 10 kilometers, from the air, or high vantage points. Disperse unit elements to the greatest degree possible using all available natural cover and concealment.

Tactical operations centers in forward areas are the most difficult positions to hide. Their need for concealment is great, so they require strict camouflage discipline. Do not allow vehicles and aircraft to approach closer than 300-400 meters. Disperse and conceal them. Have nets readily available for aircraft. Pay special attention to lights and noise at night. You will have to dig in generators and emplace radios and antenna systems as far out as possible, in different directions.

e. Cover and Concealment. It is relatively easier to conceal troops in barren mountains than on the desert floor. This is due to rugged ground, deep shadows especially at dawn and dusk, and observer difficulties in establishing perspective. You can use carefully placed rocks to hide equipment. Although, they can chip and splinter under small arms fire. You may use the normal type camouflage net, which breaks up outline by shadow, rather than the overall cover used in desert.

f. Color and Texture. All equipment should be pattern painted to blend with terrain and texture. TC 5-200 describes disruptive pattern painting for vehicles and aircraft, including colors and patterns to use. However, you can use any available local materials to improve or vary the camouflage paint. Figure 2-6 shows effective pattern usage. Color and texture of local terrain is best represented by using a little water with dirt to make it stick to vehicles. You can increase the effects by attaching local vegetation to a wide-mesh net that covers a vehicle. Attach the vegetation with foliage brackets. You may use twine or wire as an alternative to the net provided vegetation is available.

Generally, deserts do not offer much natural concealment or means for camouflage. Therefore, it is necessary for you to make maximum use of any artificial means available to the force.

Figure 2-6. Camouflage - Color and Texture.

Some or all of the following equipment should be available for every vehicle and aircraft. Although, aircraft may not be able to carry all of it:

g. Desert Camouflage Nets. Two basic types of camouflage nets are available, the standard net and the light weight camouflage screening system (LWCSS), desert version.

(1) Standard Net. The standard net used in temperate climates is wide mesh, garnished with narrow multicolored strips running in different directions. It relies on the casting of irregular shadows to break up outline. Such a net is not suitable for desert operations.

(2) LWCSS. The LWCSS is the preferred net. This net provides concealment against visual, near-IR, and radar target acquisition/surveillance sensor devices. Additionally, the transparent version of the LWCSS allows U. S. units to camouflage radars (less CW type radars) without degrading operations.

A desert camouflage net should be a complete cover. It depends on its imitation of the ground surface, both color and texture, for its effect. The alternatives, in order of priority, are

- the specially produced desert pattern net of the light weight screening system.
- an open weave cloth, colored as appropriate to the soil or "patched" and stitched to an ordinary wide mesh net. This provides both color and texture. You can suitably garnish it with radar-scattering plastic, such as that used in the light weight screening system, and with any existing local vegetation.
- a cover of close weave cloth colored as appropriate.
- a standard net garnished solid, threaded in long straight strips and colored to harmonize with the terrain. You must maintain the garnishing.

The number of nets issued depends on the size of the equipment you must cover. You should use a quantity sufficient enough to allow a gradual slope from the top to earth of not more than 15 degrees. Each company size unit should have a spray gun and various tints of paint for temporary variations in net color to match the terrain.

When using nets for stationary equipment:

- Do not allow nets to touch sensitive items such as helicopter rotor heads and radio antennas that may cause a net to catch fire.
- Do not pull nets so tight that each supporting pole stands out.
- Ensure the net does not prevent the equipment from fulfilling its primary task. In some equipment such as helicopters, a net must be easily removable to reduce reaction time.
- Avoid straight edge patterns on the ground, which indicate something is there.

h. Burlap. Use burlap that is spray painted in a nondescript desert color, to cover all reflecting surfaces, excluding fire control optics. Also, you can use it for shadow-producing areas under vehicle bodies, including tank suspensions. Aircraft equipped with windscreen covers will not require burlap.

i. Poles. Use natural or man-made poles to raise the nets from the equipment, thereby hiding its shape. You must bring them into the area of operations. Remember, they will be extremely difficult to replace in the desert if lost or damaged.

j. Mushrooms. Made locally of thin iron tubing, the "mushroom" resembles an open umbrella without its cover and with the end of the spokes joined together. Its slotted shape fits into a socket welded on to the top of a tank, personnel carrier or self-propelled gun. The mushroom lifts the net above the vehicle. It conceals the vehicle's shape, increases air circulation, and permits the crew or team to use the top hatches.

k. Pegs and Pins. Use wooden pegs or long steel pins, depending on soil consistency, to hook and hold a camouflage net to the ground away from the vehicle.

l. Machetes. Use machetes to cut desert scrub if it exists in the immediate area.

CAUTION

WOOD SHRINKS IN THE DESERT. MAKE SURE WOOD HANDLED TOOLS SUCH AS AXES AND MALLETS ARE SECURE BEFORE USING.

m. Mallets. Use mallets to drive pegs and pins into the ground.

4. Aircraft Concealment.

Stationary aircraft take a long time to conceal as they are fragile in comparison with other equipment. Aircraft have a considerable heat signature, and must be readily accessible for maintenance. The more you conceal them, the greater their response time is likely to be. When aircraft approach and land at a site where they will stay for some time, the following actions should be taken in sequence:

(1) Aircraft must approach the site terrain-masked from enemy surveillance.

(2) Close down the aircraft as soon as possible.

(3) Cover all reflective surfaces.

(4) Tow or push the aircraft into shadow if possible.

(5) Depending on the type, shift the main rotor until it is at an angle of 45 degrees with the fuselage. Drape a net over the rotor and fuselage. Picket the rotor to the ground.

(6) Conceal the remainder of the aircraft.

5. Field Artillery Dispersal.

Enemy target acquisition capability and counter-battery fire poses a major threat to field artillery units. Greatly increase your survivability by practicing timely movement and dispersion. Set up a method or SOP to react to enemy counter-battery fire. For example, when you are about to bring effective fire on a unit (unit bracketed by adjusting rounds) or you bring effective fire on a position, you could automatically or on signal, disperse your firing battery. Prearrange dispersal patterns. The unit would then regroup and move to and occupy a previously selected position. Organize the battery to maximize dispersal. Stagger gun positions, and minimize ground storage, especially of ammunition. The ability to disperse instantaneously can significantly reduce vulnerability of firing batteries.

6. Air Defense Artillery Concealment.

Air defense artillery are priority targets for enemy air and ground units. The LWCSS degrades the use of the HAWK CW radar, so concealment of the HAWK will be more difficult since it must be free of camouflage. Additionally, concealment is difficult since all ADA weapons must be maintained in a high state of readiness. Air defense units must rely on the following:

a. Digging-in. Allow generators, if dug-in, adequate air space for cooling.

b. Concealment. Conceal vehicles, not weapons and radars. Rocket motors may set camouflage on fire. Cover radars with radar-transparent light weight screening systems, if available.

c. Siting. Carefully site in the pattern of terrain. Do not place other equipment too close, to minimize the possibility of attracting the enemy's attention to the site.

7. Engineering Concealment.

Engineer activity often precedes operations. It is important that units conceal their activity from enemy surveillance. Use the following guidelines:

- Employ the minimum number of equipment and personnel.
- Keep idle equipment well away from the site, dispersed, and concealed.
- Complete all possible preparation well away from the site.
- Follow the ground pattern if possible.

8. Trains Concealment. Trains must rely on concealment for a large part of their protection. The following guidelines will assist unit commanders to conceal stationary and moving trains.

- All vehicles of a given type should look alike. This will make it difficult for an enemy to pick out critical vehicles such as water and fuel trucks in a column. Canopies over fuel trucks not only disguise them but also prevent radiant heat striking the fuel containers.
- Vehicles should follow the tracks of the preceding vehicle if it is possible to do so without breaking through the crust. This makes it impossible for an enemy intelligence interpreter to calculate how many vehicles have passed.
- Suppress noise. Remove cab doors, for example, to avoid the possibility of slamming.
- Screen exhaust systems to reduce heat signature.
- Never form vehicle patterns when stationary or moving.

9. Supply Points. A supply point is likely to be in such a location that its main threat will be visual, either by eye or photograph. Normally, you can place greater emphasis on selecting positions for concealment rather than tactical efficiency, particularly in situations of limited air defense cover. Use the following guidelines:

- Space stocks irregularly in length and depth to the maximum extent possible so there is no definite pattern.

- Pile stocks as low as possible and preferably dug-in (for example, a pile of gasoline cans should be only one can high).
- The shape of the area should not be square or rectangular, but follow the local ground pattern.
- Cover stocks with sand, gravel, burlap, netting, or anything that harmonizes with local terrain. Gradually slope the sides with soil to the top of the dump.
- Mix the contents of each supply point so the destruction of one will not cause immediate shortage of a particular commodity.
- Select a location that has existing trails. Vehicles must use existing trails when possible.

PART B - WEAPONS MAINTENANCE IN A DESERT ENVIRONMENT

1. Weapons.

Weapons may become clogged or missiles jammed on launching rails due to sand and dust accumulation. Sand or dust-clogged barrels can lead to in-bore detonation. Keep muzzles covered by a thin cover so you can fire an explosive projectile through the cover without risk of explosion. Also, cover missiles on launchers until required for use. Use only the absolute minimum amount of lubrication on working parts of weapons. It may be preferable to have weapons totally dry, since damage caused during firing will be less than that produced by the sand/oil abrasive paste.

2. Weapons Lubrication.

Some field-experienced personnel strongly believe that soldiers operating in the desert should not lubricate any weapon unless it is being taken into combat immediately. Conventional lubricants attract more dust and dirt than would accumulate on a dry weapon. There is no danger of rust most times of the year. Especially conscientious soldiers stuff oily rags down barrels or wrap the rags around jam-prone mechanisms. Weapons system manufacturers continue to recommend generous lubrication in their consulting visits to SANG, emphasizing that lack of lubricant affects the weapon both in storage and in operation. Lubricate weapons in storage according to U. S. standards. However, do not heavily lubricate weapons that are in use.

3. Ammunition.

Keep ammunition away from direct heat and sunlight. If you can hold it in your bare hands, it is safe to fire. White phosphorous ammunition filler tends to liquefy at temperatures more than 111 degrees Fahrenheit (43. 89 degrees Centigrade). This condition will cause unstable flight unless you store the projectiles in an upright position.

Experience shows that consumption of artillery ammunition occurs in greater quantities than normally expected in a different environment. This is due to the expansive open terrain upon which an engagement would probably occur. Erratic ballistic behavior has been observed on artillery and tank rounds due to excessive heat.

Increase consumption planning for artillery and antitank ammunition. Store ammunition in areas with a double sun shade. Wherever possible, in addition to the double sun shade, store the ammunition

approximately one meter below the desert floor. This method reduces the ambient temperature in the storage site below 100 degrees Fahrenheit (37. 78 degrees Centigrade).

4. Optics.

Blowing sand causes small pitting and scratches, which gradually degrades all optic performance. Guard against buildup of dust on optics. Dust may not be apparent until the low-light performance has severely deteriorated. It is advisable to keep optics covered with some type of cling film (plastic wrap) until operations determine their use. Whenever possible, use a soft brush to clean optics. If possible, use a low air pressure system to blow all sand out before wiping or dusting to prevent scratching the lens. Keep helicopter windscreens covered if the aircraft is not in use. Use a cover that has no sand on the underside, and secure it so it cannot vibrate against the windscreen.

Optics in central Saudi Arabia are completely free of moisture-related problems. However, in areas adjacent to the Arabian Gulf and the Red Sea, problems with condensation and moisture occur more often than usual. The major threat to optics is wind blown sand, which gradually degrades optic performance by pitting and scratching the lenses.

Regular maintenance and inspection of optics will help eliminate or control moisture-related problems. Use lens covers to prevent damage from dust and blowing sand. If possible, keep the system completely covered until ready for use.

5. Sand Accumulation.

Sand and dirt can easily accumulate in hull bottoms of armored vehicles. This accumulation, combined with condensation or oil can cause jamming of control linkages. Sand accumulation at the air bleeder valve can prevent heat from escaping the transmission, resulting in transmission damage. The operator's checks and services increase in importance in this environment.

6. Humidity.

Some deserts are humid. Where this is the case, humidity plus heat encourages rust on bare metal and mold in enclosed spaces such as optics. Keep clean and very lightly lubricate the bare metal surfaces on equipment not required for immediate use. Store items such as optics in dehydrated conditions using hydroscopic material. Those in use, keep under conditions where free air can circulate around them. Purge the equipment at frequent intervals. Wash aircraft daily, particularly if there is salt in the air. Use low-pressure sprays.

7. Temperature Variations.

a. Condensation. In deserts with high dew levels and high humidity, overnight condensation can occur wherever surfaces such as metal exposed to air are cooler than the air temperature. This condensation can affect such items as optics, fuel lines, and air tanks. Drain fuel lines both night and morning. Clean optics frequent]y. Weapons, even if not lubricated, will accumulate sand and dirt due to condensation, another reason for daily cleaning.

b. Expansion and Contraction. Air and all fluids expand and contract according to temperature. Tires inflated to correct pressure during the cool of night may burst during the heat of day. Fuel tanks filled to the brim at night will overflow at midday. Servicing these items during the heat of

day can result in under-pressures, overheating of tires and a lack of endurance due to their incorrect fuel levels. Check air pressures when equipment is operating at efficient working temperatures. Fill fuel tanks to their correct capacity as defined in the appropriate technical manual.

c. Gun Tube Bend. Gun tube bend ("droop"), illustrated in Figure 2-7, is more common in temperate climates. The cause of gun tube bend is temperature variations between one side of a tube and the other, such as a cold wind on a hot tube. It distorts the accuracy of a long-barrel, direct-fire weapon such as the 105-mm tank cannon. In the desert, it is usually in the vertical plane due to radiant heat on top of the tube while the lower side is in the shade. This produces a downward bend that causes rounds to fall short of the target. Gun tube bend can correct itself when the tube has built up an even temperature after you fire a few rounds. You may need to resight the bore as a result of tube bend. Tanks with thermal gun tube covers have built-in compensators.

d. Instruments. Precision instruments such as range finders may require adjustment several times during the desert day depending on temperature variation.

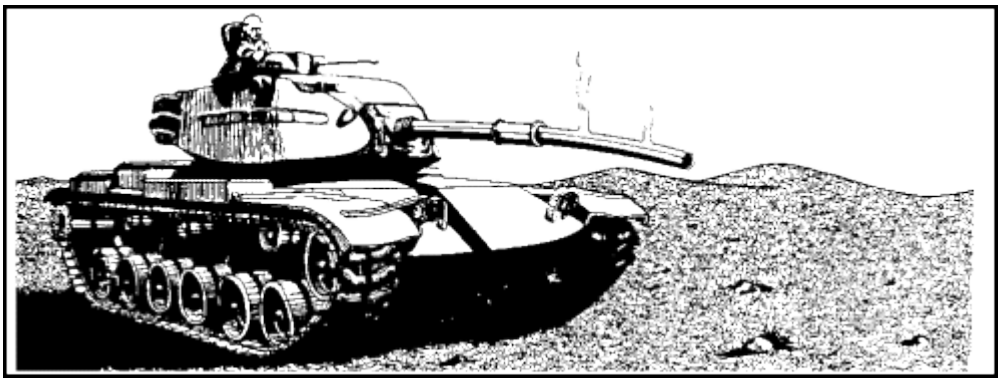

Figure 2-7. Gun Tube Bend.

8. TOW Antitank Weapon.

Some observers have complained that the TOW antitank weapon kicks up an excessive dust signature with its backblast. The complaint does not deserve as much attention, since the TOW is such an effective weapon overall. If placed intelligently (that is, away from soft sand), its visibility to an enemy would be minimal. Furthermore, in the heat of battle, anything moving would generate dust. This would camouflage the signature made by TOW. TOW is a highly effective antitank weapon in the desert. Its dust signature, albeit a consideration, is not a serious drawback.

PART C - EFFECTS ON PERSONNEL AND EQUIPMENT IN A DESERT ENVIRONMENT

1. Environmental Effects on Personnel.

There is no reason to fear the desert environment. It should not adversely affect a soldier's morale if he prepares for it and takes certain precautions to protect himself and his equipment. Remember there is nothing unique about either living or fighting in deserts. Native tribesmen have lived in the Sahara for

thousands of years. The British maintained a field army and won a campaign in the Western Desert in World War II at the far end of a 12,000-mile sea line of communication. Their equipment was substantially inferior to that in service now. The desert is basically neutral, affecting both sides equally. The side whose personnel are best prepared for desert operations has a distinct advantage.

WARNING

TEMPERATURES AND NIGHT OPERATIONS CAN LEAD TO SLEEP DEPRIVATION, WHICH CAN IMPACT MENTAL HEALTH, PERFORMANCE, AND LEAD TO ACCIDENTAL INJURY AND DEATH.

a. Discipline. The desert is both physically and emotionally fatiguing. A high standard of discipline is essential, as an individual's single lapse may cause serious damage to his unit or to himself. Commanders must exercise an exceptionally high level of leadership. They must train their junior leaders to assume greater responsibilities required by the wide dispersion of units, normal in desert warfare. Soldiers with good leaders are more apt to accept heavy physical exertion and uncomfortable conditions. Every soldier must clearly understand why he is fighting in such harsh conditions. Keep him informed of the operational situation. Ultimately, however, the maintenance of discipline will depend on individual training.

b. Welfare. Commanders must pay special attention to the welfare of troops operating in the desert. Soldiers will be unable to find any "comforts" except those provided by the command. Welfare is an essential factor in the maintenance of morale in an environment that appears-and is-harsh, especially to the inexperienced. There is more to welfare than the provision of mail and clean clothing, although, these are important. Soldiers must stay healthy and physically fit. They need adequate, tasty, and regular food, and due periods of rest and sleep. It will not always be possible such care and discomfort is inevitable. However, if troops know that their commanders are doing everything to make life tolerable, they will accept the difficulties that arise.

c. Climatic Stress. Any combination of air temperature, humidity, air movement, and radiant heat can cause climatic stress on the human body in the desert. Factors such as lack of acclimation, overweight, dehydration, alcoholic excess, lack of sleep, old age, and poor health, adversely affect your body. Your body maintains its optimum temperature of 98. 6 degrees Fahrenheit (37 degrees Centigrade), by conduction/convection, radiation, and evaporation (sweat). The most important of these in day time desert is evaporation, as air temperature alone is probably already above skin temperature. However, if relative humidity is high, air will not easily evaporate sweat, thus, reducing the cooling effect.

d. Acclimatization. Acclimatization to heat is necessary to permit the body to reach and maintain efficiency in its cooling process. Allow approximately two weeks for acclimatization, with progressive degrees of heat exposure and physical exertion. Although this strengthens heat resistance, there is no total protection against the debilitating effects of heat. Situations may arise where soldiers have to perform heavy labor before they become fully acclimated. If this happens, limit heavy activity to cooler hours and allow soldiers to rest more frequently than normal.

e. Wind. The combination of wind and dust or sand can cause extreme irritation to your mucous membranes and chap your lips and other exposed skin surfaces. Vehicle crews, even if wearing goggles, frequently complain of irritative conjunctivitis. Fine particles entering the eyes cause conjunctivitis. All personnel must use chapsticks and skin and eye ointments.

WARNING
SANDSTORMS CAN BE KILLERS IN THE DESERT

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f. Sandstorms. Sandstorms are fast, windblown sand that can be extremely painful on bare skin. For this reason, stay fully clothed. When sand storms reduce visibility to where military operations are impossible, allow only those soldiers secured to recovery lines to leave their group.

You must carry pieces of cloth or bandannas to help cover your face and neck during sandstorms. Windblown sand causes you to turn your head while driving and you'll be off course. Keep this in mind because you must compensate by buttoning up, taking constant compass readings, or using geographic reference points.

g. Desert Fog. In the desert, temperature fluctuation and moisture in the air may produce fog. The fog may form a belt that moves rapidly through an area of operation or it may hang suspended for extended periods. In many instances, this desert fog disrupted operations involving the SANG.

The almost zero visibility of desert fog seriously affects vehicle operations, land navigation, target acquisition, enemy observation, and direct fire. However, units with thorough knowledge of the terrain in their areas of operation can effectively use this fog to disengage from the enemy, or conduct raids and ambushes.

h. Water. As pointed out in Figure 2-8, approximately 75 percent of the human body is fluid. All chemical activities in the body occur in a water solution. Water aids in the removal of toxic body wastes and plays a vital part in the maintenance of an even body temperature. A loss of two quarts of body fluid (2. 5 percent of body weight) decreases efficiency by 25 percent. A loss of fluid equal to 15 percent of body weight is usually fatal.

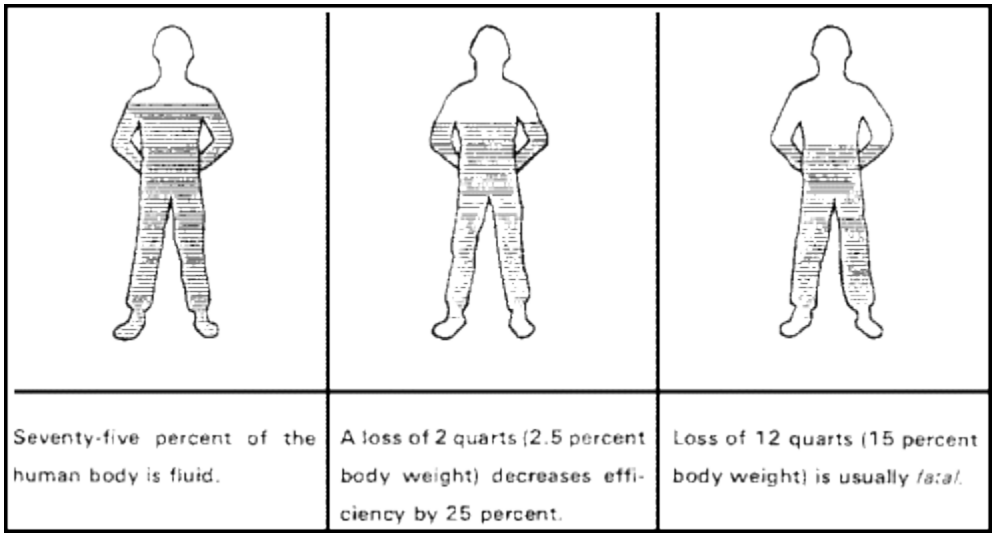

Figure 2-8. Loss of Water in the Body.

WARNING

DON'T DRINK UNTESTED WATER.

(1) Potable Drinking Water. Potable (drinkable) water is the most basic need in the desert. Make sure there is no possibility of non-potable water being mistaken for drinking water. Use water that is not fit to drink but not otherwise dangerous (merely over-salinated, for example) to aid cooling. Use it to wet clothing, for example, so the body does not use so much of its internal store.

(2) Nonpotable Water. Because local water in central Saudi Arabia is highly saline, supply units often provide "sweet" water (that is, drinking water) for cleaning and maintenance. Saline water calcifies in automobile cooling systems, reducing cooling capacity. It corrodes metals when used for washing. Isolated open wells exist in some of the wadis. Abundant water is only available from drilled wells that tap underground rivers and lakes at depths of 3,000 to 8,000 feet (914 to 2,438 meters). The water from these wells has an extremely high mineral content that makes it unsafe to drink.

(3) Bad Water. Among Westerners, there have been a few cases of gallstones and other urinary disorders following completion of extended periods in central Saudi Arabia. Some persons have drawn a link between the illness and the local water, which is high in mineral content. Purified water is available for drinking, but it is possible that it too may affect certain sensitive individuals. Expect a higher-than-normal incidence of urinary disorders, possibly as a result of poor drinking water.

(4) Liquids Consumption. Unacclimated Westerners dehydrate rapidly in the desert. The only sure solution to dehydration is forcing fluids (drinking even when not apparently thirsty on some sort of schedule, if possible). Experience shows that if a man feels thirsty in the desert, he is already on the borderline of trouble. The Arabs drink a very sweet, hot tea. It may be a good reason to imitate them.

Plan to supply unusually large quantities of drinking water. The local water is unsuitable for drinking, cooking, cleaning and maintenance. Experience in the SANG battalions indicates that a unit will require at least seven to nine gallons of water per person per 24-hour period.

(5) Water Containers. Use issued water containers only for drinking water. Carry enough water on a vehicle to last the crew until the next planned resupply plus a small reserve.

NOTE: You need approximately nine quarts of water per person per day in desert terrain.

Leaders must make their troops force drink two quarts of water per person per hour when they are active. It is a good idea to erect shade for water trailers it lets the water stay much cooler. Carry water containers in positions that

- clamp them firmly to the vehicle body to prevent seams splitting by vibration.
- provide shade and are in an air draft.
- guard against the possibility of puncture by shell splinters.
- dismount easily in an emergency.

Plastic water cans are the best containers for small quantities of water (five gallons). Water in plastic cans stays good up to 72 hours. Water in metal containers will only stay good for 24 hours. Water in water trailers, if kept in the shade, will last up to five days. Monitor the temperature of your water. If the air temperature outside exceeds 100 degrees Fahrenheit (37. 78 degrees Centigrade), change the water when it exceeds 92 degrees Fahrenheit (33. 33 degrees Centigrade). Bacteria in the water will multiply, and, if is not changed, you will end up with a case of diarrhea. Ice in containers will keep water cool. If you put ice in water trailers, remove it before you move the trailer. The floating ice will destroy the inner protection of the trailer.

NOTE: Leaders, check out your soldiers' water and make sure it is cool and still drinkable.

(6) Conservation. Train soldiers not to waste water. As illustrated in Figure 2-9, water used for washing socks is perfectly adequate for a vehicle cooling system.

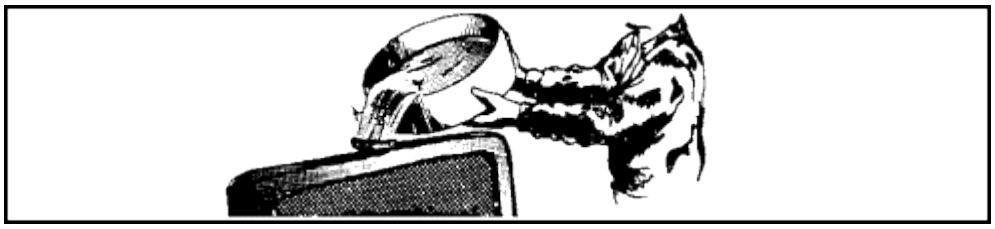

Figure 2-9. Dirty Water can be Suitable for Radiators.

Avoid disease or deliberately polluted water by taking drinking water only from approved sources. Guard against pollution of water sources. If rationing is in effect, issue water under close supervision of officers and noncommissioned officers.

You cannot train soldiers to adjust permanently to a decreased water intake. An acclimatized soldier will need as much if not more water than the non-acclimatized as he sweats more readily. If the ration

is not sufficient, there is no alternative but to reduce physical activity or restrict it to the cooler parts of the day. To retain maximum efficiency, make up any temporary deficiency. In very hot conditions it is better to take smaller quantities of water often rather than large quantities occasionally. The latter case leads to waste by causing excessive sweating and may induce heat cramps. As activities or conditions become more severe, you should increase water intake accordingly. The optimum drinking water temperature is between 50 and 60 degrees Fahrenheit (10 and 15. 5 degrees Centigrade). Lister bags or even wet cloth around metal containers helps to cool water.

(7) Dehydration. During high desert temperatures, a resting man (Figure 2-10) may lose as much as a pint of water per hour by sweating.

Figure 2-10. A Warning of Dehydration.

Sweat may not be noticeable in very high temperatures and low humidity; it evaporates so fast the skin appears dry. Whenever possible, retain sweat on the skin to improve the cooling process. The only way to do this is to avoid direct sun on the skin. This is the most important reason desert soldiers must remain fully clothed. When a soldier works, his water loss through sweating (and after requirement for replenishment) increases in proportion to the amount of work done.

Thirst is not an adequate warning of dehydration. You may not feel the sensation until there is a body deficit of one to two quarts of water. Very dark urine is often a warning of dehydration. Encourage soldiers to always drink their requirement readily. If necessary, coerce soldiers to drink more than they think necessary, especially during periods of acclimatization. Packets of artificial fruit flavoring will encourage consumption due to the variety of pleasant tastes.

i. Affect on Eating Habits. Fresh fruit and ice cream raise men's spirits and brighten menus on long maneuvers. It is a problem to transport and preserve these foods in the desert heat, but the payoff in improved morale is worth the trouble. Certain foods, though hard to keep under desert conditions, have intangible value in the field. They should be set aside before an operation for shipment to key elements at the right time.

Alcohol lessens resistance to heat due to its dehydrating effect. Avoid smoking, particularly during the day. It increases the desire for water.

Units performing sustained heavy activities such as a forced march or digging in, may need more than three gallons of drinking water per person at 80 degrees Wet Bulb Globe Temperature Index. Any increase in the stress will increase this need.

j. Salt. Salt in correct proportions is vital to the human body. However, the more a man sweats, the more salt he loses. The issue ration has enough salt for a soldier drinking up to 4 quarts of water per day. Unacclimatized soldiers need additional salt during their first few days of exposure and all soldiers need additional salt when sweating heavily. The salt requirement guide is shown in paragraph 2b of lesson 1.

If the water demand to balance sweat loss rises (you sweat more), extra salt must be taken under medical direction. However, too much salt may cause increased thirst, a feeling of sickness, and can be dangerous. To avoid this, follow these general rules:

- You should take extra salt only in proportion to the water you drink.
- Strictly control the quantity taken, in any form, according to medical advice.
- Do not use salt tablets unless dissolved into a solution, such as two tablets per one-quart canteen.

Salt all drinking water to a concentration of 0. 1 percent. This is a convenient way to provide additional salt when the salt in food is not adequate. Test water before adding salt. Some sources are already saline, especially those close to the sea.

k. Clothing and Necessities. Standard light-weight clothing is suitable for desert operations. Although, it should be a camouflage color, not fatigue green. Figure 2-11 shows some guidelines on how to dress.

Each soldier should have the following equipment:

- Sweater, field jacket, a woolen scarf for cold and night use and a cotton one for day use.
- Sleeping bag.
- Chapstick (personnel allergic to chapsticks should use vaseline), anti-sunburn ointment, salt tablets, foot powder, and insect repellant. Eye lotion or drops can also be useful.
- Goggles and sunglasses. These must not hinder peripheral vision. Keep them in a sealed case to prevent scratching them when they are not in use.
- A lensatic compass, if available.
- Web belt with two-quart canteen attached. Bottled water.
- Combat boots.

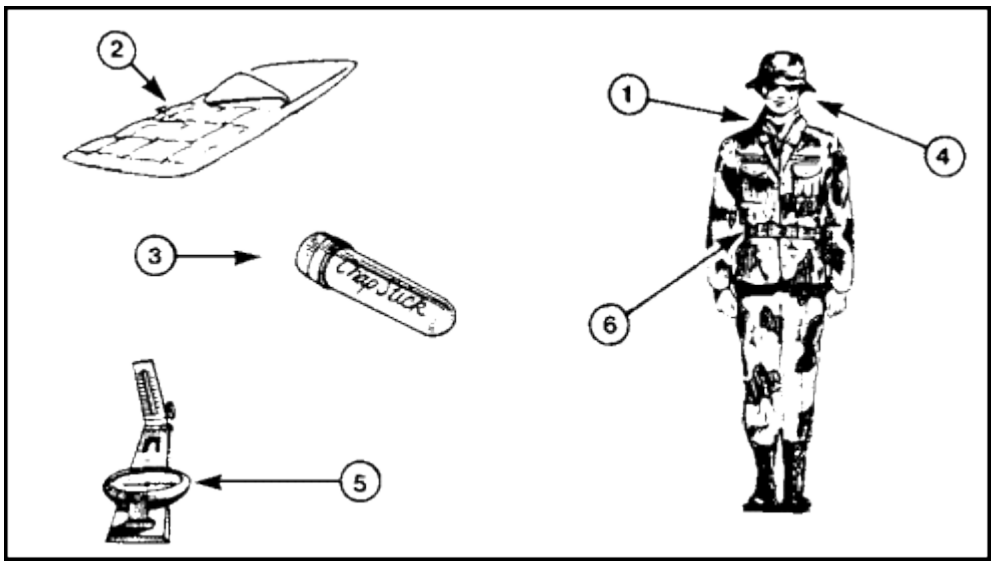

Figure 2-11. How to Dress.

Wear nonstarched long sleeve shirt and full length trousers, tucked into combat boots. However, tankers and field and air-defense artillerymen live in an environment of oils and greases with high risk of burns if enemy fire hits their vehicles. They may require special clothing, which nonetheless must be able to "breathe. " You should not wear jungle boots since sand will sift into them. Wear a scarf or triangular bandage loosely around your neck. Use it to protect your face during sand storms, as a sweat rag, and to protect much of your face and neck against sand and sun. The kevlar helmet, with headband properly adjusted, offers enough airspace for air circulation and gives a certain amount of eyeshade and neck protection.

(1) Eye Protection. The importance of wearing eye protection in the desert cannot be overstressed. Some people prefer sunglasses, others like goggles. Both have advantages and disadvantages, but both accomplish the goal of keeping out direct and reflected sunlight and reducing the numbing effect of cold winter winds.

(2) Foot Care. Combat boots will wear out quickly in desert terrain, especially if it is rocky. The leather will dry out and crack unless you apply a non-greasy mixture such as saddle soap.

NOTE: Check your feet daily-change socks frequently!

(3) Gloves. Vehicle exteriors and tools can get extremely hot when exposed to direct sunlight even for short periods. Crew members and maintenance personnel must wear gloves to prevent first and second degree burns.

l. Hygiene and Sanitation. FM 21-10 covers hygiene and sanitation in detail. This paragraph highlights some of the points that are of special importance to the commander in the desert.

(1) Personal Hygiene. Maintain the proper standards of personal hygiene, not only as a deterrent to disease but as a reinforcement to discipline and morale. Insist upon daily shaving and bathing if water is available. Use electric razors, adapted to run from a vehicle power source, instead of "wet shaves. " It is especially important to clean the

areas of your body that sweat heavily. Change your underwear frequently and use foot powder often. A laundry and bath point, or sufficient water may not be available. Nevertheless, troops can clean themselves with sponge baths, solution-impregnated pads, a damp rag, or even a dry, clean cloth.

(2) Clothing Care. Although difficult to do, you must keep your clothing as clean as possible by washing in any available surplus water. When water is not available, airing and sunning clothing will help to kill bacteria.

(3) Health. Check troops for signs of injury, no matter how slight. The dirt of the desert fly and insects can cause infection of minor cuts and scratches. Small quantities of disinfectant in washing water can reduce the chance of infection.

Minor sickness can have serious effects in the desert. Prickly heat and diarrhea, for example, can upset part of the sweating mechanism and increase water loss. This can make the soldier more prone to heat illnesses. The buddy system ensures these problems are given prompt attention before they incapacitate individuals.

(4) Sanitation. Intestinal diseases can easily increase in the desert. Proper mess sanitation is essential. Do not bury garbage within 100 feet (30. 48 meters) of any source of water used for cooking or drinking. The burial area should be at least 30 yards (27. 43 meters) away from the kitchen. Garbage pits 4 X 4 X 4 feet (1. 2 X 1. 2 X 1. 2 meters) are suitable for one day for a unit of 100 men. Do not fill them more than one foot (30 centimeters) from the top.

Use trench-type latrines if the soil is suitable. You must dig deep, as shallow latrines become exposed in areas of shifting sand. Plan to locate them at least 100 yards (91 meters) from unit messes and 100 yards from water sources. When latrines become filled to within one foot of the surface, close them. Excess dirt must form a mound one foot (30 centimeters) high. Spray the ground surface, two feet (60 centimeters) on either side, with an approved pesticide. You must then mark the location with a sign "Closed Latrine" and the date. Use lime for flies.

2. Environmental Effects on Equipment.

Key characteristics of the desert environment that may adversely affect equipment used in the desert are:

- Trafficability.
- Heat.
- Radiant light.
- Dust and sand.
- Humidity.
- Temperature variation.
- Static electricity.

- Winds.

The relative importance of each characteristic varies from desert to desert. Humidity, for example, though disregarded in most deserts, is important in the Persian Gulf.

a. Trafficability. Terrain varies from nearly flat, with high trafficability, to lava beds and salt marshes with little or no trafficability. Well trained drivers can judge terrain so they can select the best method of overcoming various conditions.

Track vehicles are best-suited for desert operations. Though, wheel vehicles go many places that track vehicles can go, their much lower average speed in poor terrain may be unacceptable during some operations. Equip your vehicles with extra fan belts, tires, and other items apt to malfunction. Add tow ropes (if not equipped with a winch), extra water cans, desert camouflage nets, air recognition panels, signal mirrors, and a tarpaulin to protect the crew from the sun. Wheel vehicles should carry spurs, mats, or channels as appropriate.

The harsh environment requires a very high standard of maintenance. You may have to perform this maintenance well away from specialized support personnel. Therefore, operators must be fully trained in operating and maintaining their equipment. Some types of terrain can have a severe effect on suspension and transmission systems, especially those of wheel vehicles. Tanks will often tend to throw tracks on rocks. You should significantly increase the unit PLL of tires. Sand temperatures of 165 degrees Fahrenheit (73. 89 degrees Centigrade) are extremely detrimental to rubber and weaken resistance to sharp rocks and plant spines. When performing routine maintenance, check for undue wear of items affected by mileage such as wheels, steering, track wedge bolts and sprocket nuts, and transmission shafts. Check the items when completing before-, and after-operation maintenance.

b. Heat. Vehicle cooling and lubrication systems are interdependent, and malfunction by one will rapidly place the other under severe strain. All types of engines are apt to overheat to some degree, leading to excessive wear and ultimately leaking oil seals in the power packs. Commanders should be aware which vehicle types are prone to excessive overheating; and ensure troops apply extra care to their maintenance.

CAUTION

DO NOT TOUCH EXPOSED METAL WITH YOUR BARE HANDS. IT IS VERY HOT.

Temperature gauges will read between 10 to 20 degrees hotter than normal. Don't panic if your average operating temperature is 180 degrees, and when operating your vehicle, the gauge shows 200 degrees. Monitor the gauge. If the temperature keeps rising, put the vehicle in neutral and "rev" the engine up to approximately 1,200 RPMs until the gauge drops back down.

(1) Cooling systems. You must keep radiators and air flow areas around engines clean and free of debris and other obstructions. You should fit water cooled engines with condensers to avoid waste as steam through the overflow pipe. Keep cooling hoses tight (a drip a second is seven gallons in 24 hours). Operators should not remove hood side panels from engine compartments while the engine is running since this will cause turbulence, leading to ineffective cooling. Operations in hot weather or on rough terrain

increase the chances an engine will overheat. Lengthy high-speed operation, hard-pulling operations, and low-gear negotiation of steep grades or soft sand have caused overheating. Cooling system efficiency drops with the calcification of water channels caused by use of water with high mineral content. Poor cooling also will result from dirt between radiator cooling fans.

Avoid continuous use of vehicles in low gear range. Replenish radiators with potable water except in emergencies. Blow dirt off radiators with compressed air or a jet of water.

(2) Lubrication. Check oil frequently for required levels (too high may be as bad as too low). Check that seals are not leaking, and oil consumption is not higher than normal.

(3) Wood. Wood shrinks in a high temperature, low humidity environment. Equipment such as axes carried on track vehicles can become safety hazards as heads are likely to fly off shrunken handles. You must periodically dampen such items to reduce shrinkage.

(4) Communication Equipment. Dust affects communication equipment such as amplifiers and radio teletype sets. The latter, especially is prone to damage due to its oil lubrication, so you should use dust covers whenever possible. Some receiver-transmitters have ventilating ports, and channels that can get clogged with dust. You must check these regularly and keep them clean to prevent overheating.

(5) Radios. You must keep all radios, regardless of type, COOL and CLEAN. Place them in the shade and in a ventilated area whenever possible. If water is available, lay a damp towel on top of the radios, making sure you don't block the air vents. Radio operators should get a paint brush to keep radios clean. Desert tactics require dispersion, but the environment is likely to degrade transmission ranges. This degradation is most likely to occur in the hottest part of the day. If you start to lose contact, especially if noon is approaching, you must have alternate ways to communicate.

Some radios automatically switch on their second blower fan if their temperature rises too high. This normally only happens in temperate climates when they are transmitting. This may disturb soldiers unaccustomed to the environment but is quite normal as are the frequent squelch bursts. AM RF amplifiers are liable to severely overheat and burn out. Troops should turn on such equipment only when necessary (they do not affect receiving). Since they take about 90 seconds to reach the operating mode, the SOP of units using the equipment should allow for delays in replying.

(6) Thermal Cut-outs. Fitted to some items of equipment are thermal cut-outs, which open circuit breakers when equipment begins to overheat. High ambient temperatures cause overheating. You can partly avoid overheating an item by keeping it in shade and wrapping it in wet cloth to maintain a lower temperature by evaporation.

(7) Medical Supplies. Continually protect medical supplies, which deteriorate rapidly, during movement and at operation sites where extremely hot temperatures exist.

(8) Instruments. Precision instruments such as range finders may require adjustment several times during the desert day depending on temperature variation.

c. High Failure Repair Parts. Dust, sand, rough terrain and temperature extremes cause an estimated 50 percent increase in repair parts required to support a combat unit. In general, parts subject to friction fail with greater frequency in the desert than under U. S. or European conditions. In this category are practically all engine parts, brake shoes, upper and lower control bushings, wheel bearings, and carburetors. Preventive maintenance can forestall carburetor failure. Vehicles parked for long periods in the sun tend to sustain damage to exposed plastic and rubberlike dashboard tops, wipers, and trim. Rubber seals are prone to dry rot. A combination of heat and dryness makes plastic parts in the engine compartment particularly susceptible to breakage.

Mechanics will need additional stocks of friction-bearing parts, plastic and rubber parts, and rubber seals. Also, cracking and breaking of cast metal parts is common due to constant excessive vibration during operations.

On rocky deserts, the M54 five-ton truck is prone to air hydraulic cylinder failure and power-steering leaks. Tire consumption is very high. As well as increasing the unit PLL of tires, all vehicles must carry one spare tire or preferable two spare tires. About one of every three vehicles should carry jumper cables to provide for servicing dead batteries.

d. Batteries. Batteries do not hold their charge efficiently in intense heat. You will have to change battery specific gravity (sg) to adjust to the desert environment. The unit can either adjust its electrolyte to 1.200-1.225 sg or obtain sulfuric acid, electrolyte FSN-904-9372 with a specific gravity of 1.2085-1.2185. It also may be necessary to adjust the battery specific gravity to compensate for cold nights. You must keep batteries full, but not overfilled, and you should carry a reserve of distilled water. Keep air vents clean, or vapors may build up pressure and cause the battery to explode. Set voltage regulators as low as practical. You must increase dry battery supplies to offset a high attrition rate caused by heat exposure.

Portable training devices and life support equipment rely on batteries. Keep batteries out of direct sunlight. Otherwise, they will malfunction frequently. Heat quickly discharges the stored energy in batteries. Alternatives, such as power generators, also can cause problems. When exposed to extreme heat, wind, and windblown sand, they become a maintenance nightmare. Specific devices immobilized by electrical problems for the above reasons include target mechanisms, radios, and remote control units. Vehicle batteries have gone dead after short periods of vehicle inactivity (5 to 10 days). Whenever possible, hard-wire stationary electrical devices to commercial power sources. Exercise vehicles regularly.

e. Pressure. Severe heat increases pressure in closed pressurized systems such as the M2 Fire Burner unit and increases volume of liquids. Be sure that the working pressure of all equipment is within safety limits.

CAUTION

BE CAREFUL WHEN REMOVING ITEMS SUCH AS FILLER CAPS!

Air and all fluids expand and contract according to temperature. If you inflate tires to the correct pressure during the cool of night, they may burst during the heat of day. If you fill fuel tanks to the brim at night, they will overflow at midday. Servicing these items during the heat of day can result in

under-pressures, overheating of tires and a lack of endurance if the fuel tanks are not filled to correct levels. You must check air pressure when equipment is operating at an efficient working temperature. You must fill fuel tanks to their correct capacity as defined in the appropriate technical manual.

f. Dust, Sand and Winds. Dust and sand are probably the greatest danger to the efficient functioning of equipment in the desert. It is almost impossible to avoid particles settling on moving parts and acting as an abrasive.

CAUTION

DON'T LET SAND MIX WITH OIL. LIKE A GRINDING WHEEL, IT CAN WEAR METAL.

(1) Sand Accumulation. Sand and dirt can easily accumulate in hull bottoms of armored vehicles. This accumulation, combined with condensation or oil, can cause jamming of control linkages. Sand at the air bleeder valve can inhibit heat from escaping from the transmission and result in damage to the transmission. The operator's checks and services increase in importance in this environment.

(2) Sand and Mechanical Equipment. Lubrication must be the correct viscosity for the temperature and kept to the absolute minimum in the case of exposed or semi-exposed moving parts. Sand mixed with oil forms an abrasive paste. Frequently check critical items like lube fittings. If they are missing, sand will enter the housing causing bearing failure. Teflon bearings require constant inspection to ensure that the coating is not being removed. Maintenance of engines is critical in the desert. There is a possibility of sand or dust entering the cylinders or their moving parts when the equipment is stripped. It is essential to have screens against flying sand (which also will provide shade for mechanics). You may employ used oil to soak the surrounding ground or cover the sand with rocks to bind it down. Mechanics must keep their tools clean.

CAUTION

USING HIGH-PRESSURE HOSES MAY FORCE SAND AND DUST INTO SEALS AND BEARINGS.

(3) Winds. Desert winds by their velocity alone can be very destructive to large and light materiel such as aircraft, tentage, and antenna systems. To minimize the possibility of wind damage, you should give materiel such terrain protection as is available. Also you should firmly picket your equipment to the ground.

g. Static Electricity. Atmospheric conditions coupled with an inability to "ground out" due to dryness of the terrain, causes static electricity, which is prevalent in the desert. It is particularly likely with aircraft or vehicles having no conductor contact with the soil. You may cause a spark when making contact between separate materials that have a difference of electrical potential. If flammable gases are present, they may explode and cause a fire. Establish a metal circuit between fuel tankers and vehicles being refueled before, and during refueling. Ground both of them (for example, by a cable and picket or by a crowbar). A further hazard of static electricitys is with helicopter sling loads. Before loading, allow the hook to touch ground, and ground a load before unhooking. You must exercise care when handling and transporting unlike materials

that might generate static electricity. It is also necessary to turn off all switches, uncouple electrical connectors, and ground vehicle or aircraft electrically-operated weapons systems before rearming.

h. Maintenance. Dust and sand easily cause failure of such items as cyclic microphone switches, radio and signal distribution panels, circuit breakers and collective triggers. The fine grit causes small electrical motors to burn out. Wheel and flight control bearings may require daily cleaning and repacking. Flush engines daily. Check rotor heads frequently. They have less life than in temperate climates. Pay particular attention to sand-caused wear on rotor heads, leading edges of rotor blades, and exposed flight controls. More than 200 pounds of dirt has been known to accumulate in the fuselage area of helicopters operating in these conditions. You must routinely check and clean these areas to prevent a pound-for-pound reduction in aircraft lift capability.

(1) Electrical Insulation. Wind-blown sand and grit will damage electrical wire insulation over time. Protect all cables that are likely to be damaged with tape before insulation becomes worn. Sand also will find its way into parts of items such as "spaghetti cord" plugs, either preventing electrical contact or making it impossible to join the plugs together. You should carry a brush, such as an old toothbrush, to brush out such items before joining them together.

(2) Wire Deterioration and Usage. Use field wire (WD-1) to supplement 32-pair wire in the SANG field telephone system. Problems arise in attempting to maintain a continuous circuit and a reliable land-line communications system. Heavy vehicles driving over buried wire cause breaks and cuts. Dry rot on insulation exposes wire. It then will not conduct, or, at best, conducts poorly, resulting in dead or intermittently operational lines. Also, irregular tension on lines causes connections to pull away, breaking the communications link.

Shielded cable is more sturdy and reliable than wire presently used by the SANG. Shielded cable is less prone to the problems listed above, and would more effectively maintain telephone communications under desert conditions.

(3) Rubber Deterioration. Areas of packed sand and rock and lava beds occur more frequently in Saudi Arabia than in the soft sand desert imagined by many Westerners. This terrain shortens tire life. During each three-day field training exercise it underwent in 1982, the Saudi Arabian National Guard (SANG) modernized 5th Artillery Battery registered a flat tire rate of 40 percent. The rate is about standard for all units. Most flats are attributable to the wear and tear of off-road travel rather than to road heat, high temperature, dryness, potholes, or abuse. A sharp rock itself rarely punctures a tire outright, but over a short time, it weakens the tire's structure by constant wear on the tread. Tire problems may be difficult to detect when a vehicle is moving fast over rough terrain. A simple, repairable puncture can result in a ruined tire and a bent rim. It is common to see large chunks of tread ripped away after travel over lava rock. Exercise extra care in driving over lava patches and rough ground. Check tires frequently for

signs of wear and cuts. This will necessitate slower movement and tighter control over column spacing to prevent bunching at obstacles.

(4) Filtration. It takes comparatively little dirt to block a fuel line, and compression-ignition engines depend on clean air. Examine air cleaners on every type of equipment and clean them at frequent intervals. The exact interval depends on the operating conditions but should be at least daily. Use filters when refueling any type of vehicle. Keep the gap covered between the nozzle and the fuel tank filler. Fuel filters will require frequent cleaning. Oil filters will require replacement more frequently than usual. Engine oils will require changing more often than in temperate climates.

NOTE: Check all filters often.

(5) Vehicle Filtering Systems. Air, fuel, and oil filters require daily servicing in the desert. Ambient air that appears clean is actually laden with fine dust, even on a clear day. Replace all filters more frequently than recommended. Close attention to filters pays in fewer maintenance problems. It is not uncommon for an air filter to become completely useless in 3 days even with daily or more often cleaning. Stock greater numbers of filters, of all types, for use in desert operations.

(6) Vehicle Lubrication. Change oil about twice as often as recommended, not only because grit accumulates in the oil pan but also because uncombusted low-octane fuel seeps down the cylinder walls and dilutes the reservoir. Diluted oil lubricates and cools less effectively, and evaporates at high temperatures generated during engine operation, necessitating more frequent topping up. High-grade 20W-50 oil has served well in desert conditions. Change oil and lubricate undercarriage points more frequently to prolong engine and vehicle life.

(7) Fuel Contamination. One source of contaminated fuel is the reuse of gasoline tankers by the SANG to transport or store diesel fuel, and vice versa, without first flushing the tanks. The Saudi government-owned fuel company, Petromin, controls the only facility in the country for flushing out tankers. Because there is no other place to perform this service, operational necessity often forces drivers to skip this important procedure. If a unit is required to flush a tanker to transport a different product, do not include the availability of local facilities in the planning.

(8) POL Storage. Operation of mechanized forces in the desert will require many POL storage sites. In most desert areas in Saudi Arabia, storage systems are antiquated. Devices for determining the state of POL contamination may be lacking. As an example, local systems are not equipped with sampling and gauging hatches. Standard U. S. sample beakers will not fit down refill hatches. The local storage tanks also have no strapping charts for determining the precise volume from tank fluid levels. Bottom samples cannot be drawn up to test for contamination. It is not possible to determine the precise volume of fuel in local storage tanks or to determine the degree of contamination without special equipment.

i. Vehicle Recovery Operations. You can free a car or truck can from soft sand by letting about one fourth of the air out of the trapped tires. Reinflate when freed. You can also use "Sand ladders" made of reinforcing rods welded to angle irons. They are about two feet long and the width of a truck tire. You may need a shovel to free sand from around the trapped tires before the ladders can be inserted.

Carry an air pump or sand ladders and a shovel. If available, carry all three. (Sand ladders are usually carried in pairs.) Although underinflated, these improve vehicle traction in the desert. Tires are generally kept at normal road pressure to avoid damage to sidewalls from sharp rocks and to cut down on wear and tear. Increase the numbers of tow bars, ropes and matting in the unit and equip all tactical wheeled vehicles with winches (Note: Winching out a stuck vehicle has proven to be the most effective means of recovery). Another extrication procedure applicable to light vehicles stuck in very fine sand is the "rocking method. " Pile sand around all four tires. Three to four men then violently "rock" the vehicle from side to side forcing the vehicle to bounce as high as possible. As the vehicle's weight shifts from side to side, the piled sand will flow under the tires of the vehicle. Eventually, the vehicle will rise back to the level surface.

j. Effect of the Desert on Vehicle Mobility The choice of vehicle used in a desert operation has less to do with mobility than the skill of the driver. An agile vehicle will sink up to the hubs if its driver insists on gunning the engine in soft sand. On the other hand, a U. S. Dodge truck made for use on blacktop will perform acceptably offroad when operated by a driver adept at gearing, speed control, braking, and steering. For all-around maneuver-ability regardless of driver performance, the British Leyland Land Rover is high on the list, and other support vehicles (U. S. Dodge and Austrian Steyr trucks) are rated below that. This assumes operation in a "mixed" desert of soft sand, packed sand, and rock. There is no resident experience in operating in dunes. However, it is suspected that, in extensive stretches of soft sand, support vehicles would be greatly slowed by bad footing. Sand and dust and "cap rock" that support the occasional vehicle can become impassable if several vehicles use the same route. The dust cloud also presents a safety problem in reduced visibility for vehicles following in a column.

Well-trained drivers can maneuver a wide variety of vehicles over "mixed" desert without getting stuck. The majority of cross-desert travel should be on line or in echelon. Following another vehicle's tracks is not recommended except when crossing dry washes or as restricted by the topography.

k. Vehicular Desert Survival Kit. Military vehicles operating in a desert environment must have a higher degree of self-sufficiency than you would normally expect in a different environment due to the environmental extremes encountered.

Equip vehicles with the following:

- OVE, to include a small general tool kit.
- Flashlight and highway reflector (triangular).
- Fire extinguisher.
- Compass, binoculars and maps.

- Communications equipment.
- Shovel, sand ladders and tow rope/cable (at least 25 feet [7. 6 meters] long).
- Five gallons (18. 9 liters) of water per vehicle occupant.
- Personal food, clothing and equipment.
- Siphoning hose (1/2-inch outside diameter by 6 feet) (1. 27 centimeter diameter by 1. 83 meters) and funnel.
- Slave cables (one for each group of vehicles).
- Mounted vehicular air compressor with air reservoir (150 psi) and sufficient air hose.
- Jack support plate (1 foot by 1 foot piece of metal) (30 by 30 centimeter piece of metal).
- Consumables, to include oil, radiator hoses, fan belts, heavy duty tape, air and gas filters, twine, annealed wire.

l. Employment of Army Aircraft. Flying time and performance of helicopters is degraded as the altitude and heat increases. Aircraft canopies can bubble under direct heat, so you should cover them when not in use. Army aircraft may be employed in the desert as in temperate climates, within limits imposed by enemy long-range observation and air-defense fires. Do not move helicopters on the ground under their own power. Pushed or tow them by men or vehicles. You should restrict run-ups to the minimum time. They should take place on rock, oiled or wet sand if available. Always, cover all apertures (pitot tubes, for example) of aircraft not in use. Hovering close to the ground will lead to sand-ingestion by the engine, possible observation of dust clouds by the enemy, or disorientation of the pilot due to flying sand, particularly at night.

PART D - PREPARATION FOR DESERT OPERATIONS

Most U. S. Army soldiers and units are unaccustomed to operating in a desert environment. Therefore, they must make extensive preparations before conducting desert operations.

1. Factors when Preparing for Desert Operations.

When a unit is alerted for operations in a desert environment, the commander must first consider or find answers to some or all of the following questions:

- To what country is the unit going?
- What are the climatic and terrain conditions of that country?
- By what date is the unit to be ready to move?
- What areas in the United States most closely resemble the country?
- Are training areas and ranges present and available in those areas? If not, what alternative arrangements can you make?

- When are training areas and ranges available to the unit, either alone or as a part of a larger force? What arrangements must you make to move personnel and equipment to training areas?
- Will the unit be taking its own equipment overseas? If so, when will the equipment be deployed?
- If unit equipment is being sent overseas and any items of it require modification (including camouflage painting) when is this work to be done and how long will it take?
- What special equipment does the unit require for desert operations? What arrangements do you need to make to deliver this equipment, and when will it arrive?
- What special maintenance does your unit need to accomplish for weapons and equipment before deploying to a desert environment?
- Are there personnel in the unit who

  - are desert warfare instructors?

  - have any experience in desert conditions?

  - can speak any language of the host country, and if so with what proficiency? Is there any requirement to increase that number and can you do it in the available time frame?
- What assistance is available for training:

  - What instructors are available from outside the unit?

  - What training aids are needed and what is available?
- What larger force will the unit be with? Do they have any special SOPs for desert war? If not, are they producing any?
- Are all personnel physically fit (this will affect the acclimatization period)?
- How many soldiers are nondeployable? They must be replaced.
- What information is available about the enemy in terms of strength, organization, equipment, and tactics.
- What information is available about allied forces in the area of operations?
- What type of operations does the command expect?
- What is the composition of the advance party and when do they leave?

Once the commander answers these questions, he must develop a program to bring his unit to a level where it is fully capable of operating successfully in harsh desert conditions. To do this, it is first necessary to set a list of priorities for both individual and unit training. The list of training priorities in Figure 2-12 is only a guide. Modify them as necessary depending on the state of readiness of the unit when first alerted for desert employment.

It is important to remember that a unit likely will be committed shortly after arrival in the area of operations. Take maximum advantage of the preparation time available to the unit. You can do much unit training and some individual training in garrison. You can integrate some individual training subjects with unit training. Night operations will be a common occurrence in desert warfare and so you must emphasize training to fight at night as much as in the day.

Individual Training			
Priority	*Staff and Leaders*	*Specialists* (those to be trained in a desert speciality)	*Team and Crew Members*
(1)	Desert environment and acclimatization	Desert environment and acclimatization	Desert environment and acclimatization
(2)	Survival, evasion, and escape	Survival, evasion, and escape	Survival, evasion, and escape
	Camouflage and concealment	Camouflage and concealment	Camouflage and concealment
	Living in desert	Living in desert	Living in desert
	Operational area	Operational area	Operational area
	Enemy Organization and tactics	Desert Navigation, special equipment techniques	
(3)	Special maintenance and tactical deception	Equipment recognition	Equipment recognition
	Communication security	NBC training	NBC training
	Desert terrain appreciation	Local Language (if applicable)	
	NBC training		
	Desert navigation	Enemy organizations	Mines and booby traps
			First aid
			Helicopter marshalling
			Enemy organizations
Unit Training			
	Physical conditioning		
	Weapons training		
	NBC training		
	March discipline		
	Obstacles and barriers		
	Scouting, surveillance, and patrolling		
	Air defense		
	Adjustment and conduct of fires		
	Communications		
	Desert operations		
	Attack		
	Defense		

Figure 2-12. Training Priorities.

2. Individual Training.

The object of individual training is to prepare the individual for operations in a desert environment. This requires both mental and physical preparation.

In order to fight and survive in desert operations, soldiers must fully understand the desert environment. Where practicable, they should be acclimatized before arrival in the area of operations.

The requirement for acclimatization will vary slightly between individuals, but physical conditioning (fit men acclimatize more easily) is a part of the acclimatization process. Acclimatization should take place in conditions that are similar, or slightly more strenuous, than those of the prospective area of operations.

a. Camouflage and Concealment. You may divide camouflage and concealment training into concealment from the ground (including the need to avoid enemy remote sensors (REMS) and concealment from the air). Pay particular attention to movement, color, shadow, and deception. Camouflage and concealment is equally important for combat service support soldiers and combat and combat support soldiers.

b. Survival, Evasion, and Escape. Convincing a soldier that he is capable of surviving in the desert environment will do more than almost any other aspect of training to strengthen his self-confidence, and thus his morale. Include the following points in desert survival, evasion, and escape training:

- Poisoned wells will be unlikely. Some wells in the North African desert, however, have such strong concentrations of mineral salts that water taken from them may lead to intestinal irritation and subsequent illness.
- Teach survival navigation to all personnel. Do not confuse survival navigation with celestial navigation, which is taught to specialists for unit navigation.
- Although, water is the most important factor in survival, a soldier should not discard his personal weapon or navigational equipment except in the most extreme circumstances.

c. Desert Living. Following minimum preliminary training in garrison, troops can practice desert living in the field, often as part of unit training. Cover important aspects such as

- the effects of heat, including possible dehydration and salt loss. The need to maintain the body fluid level.
- maintenance of morale and the ability of the individual to accept the challenge of the desert. Self discipline and common sense.
- environmental effects such as those of sand, wind, and light.
- water discipline.
- first aid for heat illnesses. Issue each soldier a memory aid card showing symptoms and immediate treatment.
- hygiene and sanitation.
- correct clothing and equipment, including how to wear and maintain clothing.
- the effects of temperature variation.
- precautions against snakes. (See Part 2).

To the extent possible, the commander should train his unit in terrain and environmental conditions similar to what he expects to find in the operational area. It would be both short sighted and dangerous for example, to allow unlimited water use, such as that use for bathing, if the expected operational area is totally without water. To further accustom the soldiers to hardships, keep to a minimum any contact with garrison or other urban areas, except for medical or welfare reasons. Once field training has started, bring necessary supplies to field locations. Don't permit items that are unlikely to be available in the operational area (commercial soft drinks and foods). To gain the maximum value from this training, cut off the unit from all other human contact for the duration of the field exercises.

d. Enemy Organizations and Tactics. You can teach this in garrison on sand tables and map maneuvers, followed by Tactical Exercises Without Troops (TEWT) and unit exercises in the field. If enemy equipment is available, bring it to the unit for firsthand study.

e. Desert Navigation. Although maps used in field training will be those of the local area, obtain enough maps of the operational area to allow distribution for study and possible use during garrison training. This is particularly important if the operational maps use foreign words to describe terrain, such as wadi, summan, hidiba, and dikaka.

Current equipment employed by units to determine their position in the desert is the vehicle dead-reckoning navigation set. This set contains items such as protractors, a lensatic compass, and a sun compass including its necessary tables. Use it to determine approximate magnetic and celestial azimuths and for plotting approximate positions determined by dead reckoning. The sun compass also permits a unit to maneuver on a constant azimuth without the navigator dismounting continually to take magnetic bearings.

The two types of compass are complementary. The sun compass is unaffected by its surroundings, easy to read but requires a higher level of training. You cannot use it when the sky is overcast, or at night. You can use the magnetic (lensatic) compass day or night provided its individual compass error and the local magnetic deviation are known. However, a magnetic compass may not be accurate when used from a vehicle. A magnetic compass may not be adequate on its own when using dead reckoning at night. You may need to employ trained navigators who can use sextants to establish reasonably accurate positions by the stars. Train your navigators on dead reckoning, sun compass, and bubble sextant (if available).

Even if equipped with sophisticated equipment, the unit would be prudent to train a nucleus of personnel on alternative methods. Basic navigation training (including the sextant) takes about 10 days. The use of the vehicle odometer may also be helpful. By multiplying the miles covered by . 62, a unit can convert the odometer miles to kilometers.

f. Operational Area (Host Country). A description of the host country should cover only those facts that apply to forthcoming operations, for example:

- Geographic description.
- Climate (throughout the year).
- Population density.

- Industry and agriculture.
- Language(s) (phrase books may be issued).
- Communications and transportation network.
- Important customs and the behavior expected of U. S. Army personnel. (These can be very important: speaking to a woman in some Arab countries, for example, can be offensive to the local inhabitants).
- The armed forces (and possibly police), including organization, equipment, and rank structure.
- The situation that has led to the introduction of U. S. forces and why U. S. forces are being introduced. No soldier should have to question why he is fighting for a country other than his own, if this is the case.

Treatment of these subjects will vary according to category. Personnel who need additional information such as the country's history, can find it in the appropriate DA 550 series pamphlet.

g. Desert Maneuvers. The influence of the desert environment on tactical operations should first be taught as a theoretical subject for a limited number of leaders and commanders, down to platoon level. Leaders then train their own units during unit training. The emphasis should be on small unit tactics, including combined arms operations. Cover the following additional subject matter:

- Terrain in the operational area, emphasizing differences and similarities with the training areas the units will use.
- Application of concealment, using terrain and artificial means such as smoke; the application of maneuver techniques.
- Mobility in the desert.
- Command and control techniques for desert operations.
- Navigation and station-keeping.
- Conduct of fire in desert operations.
- Resupply during desert operations.

h. Desert Terrain Appreciation. Leaders should focus on the effects of different types of desert terrain on capabilities and limitations of unit equipment. You need to highlight the impact of the terrain in the likely operational area on vehicular trafficability, fields of fire, and observation. When possible, crews and small unit leaders should learn to appreciate desert terrain from practical experience in terrain as nearly similar as possible to that in the likely combat zone.

i. Medical Training Considerations. The unit surgeon can provide you with valuable information on the medical implications of operations in this environment. He also can advise unit commanders on training of preventive medicine concepts essential to minimize nonbattle

injuries due to environmental factors. These casualties, due to lack of consideration of preventive medicine concepts, can far outnumber combat casualties.

j. Special Equipment Techniques. The environment, as described earlier, will affect nearly all equipment in one way or another. The purpose of this training is to train operators. Training should include:

- Likely affect on the equipment they operate,
- Efficient operations of the equipment within limits imposed by the environment, including tactical limitations of the equipment. For example, helicopters may have difficulties flying NOE; you normally operate radios on reduced output due to the environment and enemy ECM.
- Preventive maintenance, employing any special techniques required by the desert environment. The appropriate equipment technical manual or lubrication order provides specific information concerning hot climate operations and maintenance.
- Basic desert recovery and repair techniques, including defensive measures, and camouflage required during recovery and repair operations,

Orient instruction towards the expected operational area. For example, it is possible to keep radios cool by using ice packs; but you will teach a false lesson if ice packs are not going to be available in the area of operations.

k. Equipment Recognition. You can divide this subject into four categories:

(1) Enemy ground equipment and helicopters.

(2) Enemy aircraft.

(3) Allied ground equipment and helicopters.

(4) Allied aircraft.

The order of priority and detail of training will vary according to the unit, the degree of equipment identification already known, and individual specialty. The first priority for air defense equipment operators, for example, will be to recognize enemy and allied aircraft visually. A tanker needs to be able to identify enemy ground equipment, but not necessarily over the wide span required by a soldier in military intelligence. Visual recognition will always be a higher priority than sound identification, but teach the latter if you have time and equipment. Place special emphasis on allied equipment both ground and air. If both allies and the enemy have similar equipment, you must teach separate national identification markings. The command must train everybody in vehicle recognition, because combat service support and combat support units as well as combat units may have to protect themselves against an enemy breakthrough.

l. Special Maintenance and Supply Techniques for Staff and Leaders. Special maintenance techniques you need to address are the same as those taught to specialists but need only emphasize aspects that ordinarily require control, supervision, or affect the employment of equipment in desert terrain. This training should include any special handling techniques

required in the operational area, appropriate technical manuals and training circulars as background. Modify training according to:

- Modified table of organization and equipment (MTOE) and mission of the unit.
- Supply situation expected in the area of operations.
- Capabilities of logistic units likely to support unit operations with special attention given to units not normally found in conventional operations (well-drilling teams, transportation cargo carrier companies, for example).

m. Nuclear Biological and Chemical (NBC) Training. Wearing protective clothing and masks in the desert environment will make a person extremely uncomfortable. Soldiers should not participate in strenuous activity while wearing protective clothing until they are acclimatized. Emphasized the following points:

- The value of being uncomfortable rather than dead.
- The need to avoid heat illness by

  - reducing the labor rate to the minimum, and delaying work until cooler hours.

  - maintaining proper body water and salt levels, particularly during a time of chemical threat.

  - being vigilant to detect the first symptoms of heat illness in others.

  - the requirement to increase operational times as troops will move more slowly when wearing protective clothing.

n. Tactical Deception Operations for Staff and Leaders. The enemy directs its tactical operations based on peculiarities of key personnel, the intelligence picture of the friendly forces, the area of operations, and doctrine. The enemy uses many bits and pieces of interrelated intelligence for composing their picture of friendly force capabilities, limitations, intentions, and actions. By implementing OPSEC procedures, friendly forces can succeed in limiting (blanking out) the enemy's capability to produce accurate intelligence. The enemy continuously tries to augment the intelligence collection capability, knowing that friendly forces can limit enemy intelligence collection assets. Thus, while friendly OPSEC efforts identify and limit enemy efforts to collect accurate intelligence information, our intelligence efforts must focus concurrently on the planned deception of the enemy.

Some important aspects about deception that you should remember are:

- Make use of the natural environment, for example, create false dust clouds to mislead the enemy as to the intentions of the friendly force.
- The enemy will attempt to deceive as well, so the friendly force must clearly deceive without being deceived.
- Plan your deception operations and coordinate them with the force headquarters planning the operation, normally no lower than division. In any event, the division

should limit those deception activities that can be undertaken by its subordinate units without the approval of division headquarters.

- As for any other operation, operation security measures must be taken before, during, and after a deception operation to prevent the enemy from ever knowing that he has been deceived.

o. Communication Security. Because of the importance of radio communication in desert operations, expect that the enemy will employ any electronic support measures (ESM) and electronic counter measures (ECM) available to him. Although, there are no special electronic counter-counter measures (ECCM) peculiar to desert operations, some points you must consider are:

(1) Electronic Security. The enemy will try to intercept speech transmissions, attempting to break voice codes in the process, and use the intelligence gained. He will also attempt to determine the locations of units, using direction finding equipment. Use radios fitted with on-line cryptographic equipment to the maximum extent possible. Yet users must guard against excessive chatter.

(2) Traffic Flow. The enemy can pick up variations in the amount of communication traffic and have warning of impending operations. Message flow must remain constant. Although this may mean you must send routine information, normally sent by radio, by other means before an operation.

(3) Concealing Antennas. This would be easy amid, for example, saguaro cactus in the Sonoran Desert. Such aids are unlikely to exist in the Middle East except vegetation in an oasis. Avoid siting tactical operations centers on high points, in isolated buildings, or areas where new tracks can be easily apparent to enemy reconnaissance. Look for areas that have strong vertical lines such as volcanic cracks, where antennae masts will not stand out. Raise antennas only the height necessary for communication with distant stations.

You can find additional information about ECCM techniques in the How-to-Fight manual for the appropriate level of command.

p. Direction Finding (DF). It is probably impossible to avoid the danger of direction finding, yet impose electronic silence if any other means of communication can be used. The following guidelines can degrade enemy DF capability:

- Transmit using minimum power necessary for the job.
- Use directional antennas. Distant stations should be terrain masked to the front when operating.
- Make short and as few transmissions as possible.
- Locate tactical operations center (TOC) antennas as far from a control station in the TOC as possible.

- Take the following actions if jamming occurs:

  - All stations check that their own transmitters are not inadvertently blocking the net with a "hot microphone. " Attempt to work through it without mentioning it on the air.

  - If it is impossible to work through, switch to an alternate frequency according to SOP. One good method is to switch exactly on the next quarter-hour on the clock or some other prearranged system.

- Use twin transmission if enough radios are available and blanket jamming is not being used. This involves transmitting simultaneously on two frequencies with distant stations picking up the unjammed frequency only.

3. Unit training.

When determining unit training requirements, the commander must first consider the training level of his unit when alerted for deployment. When there's no time for a comprehensive training program, the commander must concentrate on those areas where his unit is least proficient, considering the priorities previously described. In any event, in order to operate in the desert environment, the unit must above all, be physically fit. Thus physical conditioning is of paramount importance.

a. Physical Conditioning and Acclimatization. When possible, these take place simultaneously. When a unit is training in a hot environment, begin conditioning with physical training at night or during the cooler part of the day. Then, work up to rigorous training such as foot marches in open sand terrain at midday. Emphasis on mounted operations in desert warfare does not imply that foot marching can be disregarded. Continue physical conditioning after arrival in the area of operations. Make medical advice and unlimited salinated water always available during physical training in hot weather.

b. Weapons Training. Soldiers must train to proficiency at all ranges. Emphasize accuracy at maximum effective range both day and night. Fire during the heat of day to condition soldier's to heat haze and mirages. Also emphasize maintenance of individual weapons in view of sandy desert conditions.

c. NBC Training. The purpose of unit NBC training is to train individual soldiers to become proficient as a team while wearing protective clothing and masks, and in the case of combat vehicles, while buttoned up. Conduct this training both day and night, until the unit can operate for up to 48 hours under these conditions.

d. March Discipline. Although of particular importance to combat support and combat service support units, all units should train in tactical road marches. Training should emphasize

- off road movement over open terrain, irregular spacing when moving in convoy, the need to maintain sufficient distances between vehicles to prevent "dust blindness. "

- actions to be taken when stuck in sand, and when a vehicle breaks down.

- vehicle camouflage, removal of tracks that would reveal friendly locations, the need for dispersion when halted, and air defense drills.

e. Obstacles and Barriers. Some desert areas have natural obstacles such as wadis or other terrain features. Often, however, if you must slow enemy movement, you will need to use artificial obstacles. A minefield, to be of any tactical value in the desert, must usually cover a large area. This requires mechanical means and engineer support to do the job. Since there are often too many avenues of approach to cover with mines, it is usually best to employ mines to cover any gaps between units, especially at night. Minefields are most effective when covered by observation or fire. Units should train soldiers to lay mines using gloves, since human scent attracts desert animals who may attempt to dig them up. Emphasis should be on antitank mine fields since combat vehicles are the most dangerous threat.

f. Scouting, Surveillance, and Patrolling. This training should emphasize the

- effects of the environment on scouting, observation, and surveillance techniques.
- effects of the environment on surveillance, target acquisition, and night observation.

g. Adjustment and Conduct of Fire. The principles for adjustment and conduct of fire in the desert are like operations in more temperate climates. Though somewhat peculiar to desert operations, keep the following considerations in mind:

- Obscuration at the gun from either sand, dust, smoke, or in combination can affect direct fire adjustment.
- There may be major inaccuracies of initial rounds from indirect fire weapons due to misjudgment of target location.
- The target may be concealed by sand or dust if rounds land short, on, or near the observer target line.
- Heat haze and mirages can mislead gunners and observers as to target location. This condition can particularly affect antitank guided missile gunners.

Gunners should concentrate on looking through obscuring conditions, not at them. Armor piercing discarding sabot (APDS), for example, will emit a vivid flash when striking armor. This can frequently be seen through dust and dirt. Although, it may produce the same effect if striking short on rock. Direct-fire gunners may have to depend on flank observers, who may be any person on the battlefield equipped with a radio. If you lose observation, subsequent corrections are very unlikely to cause a second round hit. Gun crews will have to use standard range changes or preferably target form adjustment. Both methods rely on the gunner maintaining an accurate sight picture over the whole of his reticle as the immediate front of the target will be totally obscured by flying dirt if the round landed short.

There are techniques you can use to overcome the obscuration/sending problem. For example, a heavy section of a tank platoon firing APDS might use either of the following techniques shown in Figures 2-13 and 2-14:

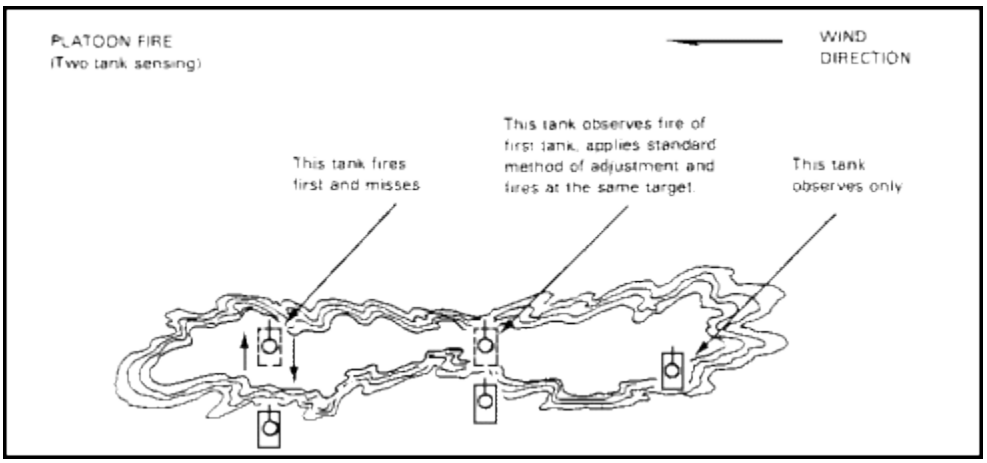

Figure 2-13. All Tanks Start the Engagement With Same Range and Ammunition Indexed.

An observer requesting indirect fires needs to ensure that initial rounds land beyond the target to preclude short rounds obscuring the target. He then adjusts accordingly. Units may need to use white phosphorus (WP) ammunition to ensure observers see the fall of the shot.

Heat haze varies throughout the day. It's greatest impact is on ATGM gunners when both gunner and target are within two or three feet (one meter) of the desert surface. Hence, ATGM gunners should have a line of sight approximately six feet (two meters) above the intervening terrain. Preferably, they should site so the sun is behind them.

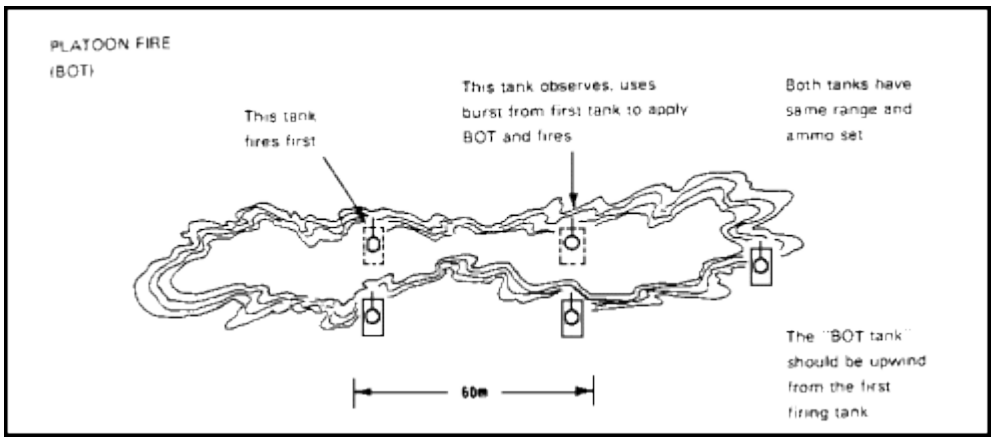

Figure 2-14. Distance Between Tanks. Must Be No Greater Than 60 m.

h. Air Defense. In desert operations any type of unit, be it tank, infantry, trains, tactical operations centers, or supply points, can expect to be a target for air attack. Air attacks may be from fighter bomber aircraft using cannons, missiles, bombs, napalm, and machineguns or from attack helicopters using machineguns, rockets, or missiles.

NOTE: Assume enemy air superiority during all field training.

Whenever possible, fly simulated fighter bomber attacks and attack helicopter missions against the unit. When practical, take aerial photographs of positions and interview pilots to assist in critique of air defense, both passive and active. Points that should be emphasized are:

(1) Passive Air Defense Measures. Passive air defense measures should be taken routinely. When stopped for any period of time, take every advantage of whatever cover and concealment is available. As previously described, natural cover and concealment will be difficult to find in many desert areas. Nevertheless, irregularly disperse and dig-in vehicles, particularly unarmored vehicles, or provide revetments. When appropriate, post air guards, trained in aircraft recognition, with clear instructions on what to do when sighting aircraft. Use artificial camouflage.

(2) Active Air Defense. Active air defense techniques used in desert operations are the same as those described in How-to-Fight manuals, appropriate to the level of command. However, at small unit level, give additional emphasis to air defense using small arms. When enemy aircraft engages combat vehicles on the move, their immediate action will depend on whether they are maneuvering in contact with the enemy. If they are in contact, they should continue to maneuver, relying on some overwatch elements and air defense artillery to engage attacking aircraft.

(3) Vehicles facing attack by enemy aircraft in an area where cover is not available, should move perpendicular to the attacking aircraft to evade rocket or machine gun fire. Engage the aircraft with small arms fire, if possible. The remainder of the unit meanwhile should mass small arms fire to the aircraft's front. Sudden variations in course also may distract the pilot.

(4) When attacked by napalm, turn vehicles in the direction of attack. Then, stop and switch off engines to avoid napalm ingestion, button up, fire the smoke launcher system if so equipped, while firing machineguns in the direction of the attack.

i. Communications. Good communications in this terrain will often depend on the state of mind of the operators. They must be enthusiastic, persistent, and determined to make and maintain contact. Commanders will probably find that it is usually the same station(s) that lost contact first. Unit training should concentrate on ECCM techniques. When conducting field training, higher headquarters can provide assistance in the form of small teams to jam unit nets. Practice actions to take when losing radio contact due to heat.

j. Desert Operations. This training should be as realistic as possible. Constrain field training by environmental influences on tactical operations.

LESSON 2
PRACTICE EXERCISE

Instructions The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you have completed the exercise, check your answers with the answer key that follows. If you answer any item incorrectly, study again that part of the lesson that contains the portion involved.

Situation: You have deployed along a demilitarized zone somewhere in a desert of the Middle East. It is vital you know desert camouflaging, personnel and equipment, and preparation.

1. Your brigade of tracked vehicles is told to set up a long-term bivouac in desert terrain. You instruct your troops in the below-ground shelter method which

   ○ A. reduces mid-day heat as much as 50 degrees Centigrade.

   B. should be constructed during mid-day pause in operations.

   C. reduces the midday heat as much as 30 to 40 degrees Fahrenheit..

   D. is protected from accidental run over by a tank by securing the cover with a rigid center-pole mast.

2. Your desert outpost has little cover and concealment from lack of heavy vegetation and your immediate concern is to eliminate the shine reflecting off some vehicle components. Since there is an engineer company nearby, you tell your troops to

   A. use dozer blades for constructing geometrical angles of radar-reflecting sangars approximately three meters high around vehicles.
   B. use cranes and winches that erect camouflage nets for total concealment from air reconnaissance.
   C. use mine-clearing rollers to break up the hardest ground so helicopters can fly Nap-Of-the-Earth.
   D. use matte camouflage paint, grease and sand to smear on vehicles and see through cloth to attach on vehicle windshields.

3. Your tanks are equipped with smoke dischargers. A factor concerning smoke generation is

   A. smoke blinds enemy radar during periods of high ambient temperature.
   B. the best conditions for employment of smoke are at mid-day with turbulent air conditions.
   C. a large-area smoke screen normally requires prestocking of smoke ammunition for artillery or mortars.
   D. a tank fires local smoke as a stop gap when attacking from its

camouflaged hull-down position.

4. An important guideline concerning your brigade assets is

   A. aircraft are relatively hard to conceal because of their heat signature and maintenance requirements.
   B. your field artillery battery requires a long-lead time for static defensive positioning and ammunition requirements.
   C. your ADA unit relies on mobility and use of "mushrooms" above radars.
   D. engineer activity follows operations with equipment kept in line for rapid maximum convoy deployment.

5. An important factor of weapons maintenance in a desert environment is

   A. working parts of weapons should be kept well lubricated.
   B. artillery ammunition is consumed in smaller quantities because precision targeting is possible in open terrain.
   C. gun-tube bend totally distorts accuracy, causing rounds to fall short, and making it necessary to resight the bore.
   D. optics never should be covered with a plastic trash bag since if glass does not "breathe" it may crack.

6. You notice your personnel are fatigued and irritable under desert conditions. Therefore, you conclude

   A. you need to "cool out" on discipline, "lighten up" on physical training and be tolerant of irregular snacking on "junk food."
   B. those personnel hit by climatic stress are more adversely affected by lack of proper acclimatization, overweight, dehydration, alcoholic excess, lack of sleep, old age, and poor health.
   C. you can shorten acclimatization time to a few days by shedding excess clothing while exercising during the hotter hours.
   D. you will have to advise your men that a loss of a quart of body fluid decreases efficiency by half.

7. To maintain proper personal hygiene standards when water is limited and to deterrent disease in desert environments, it important that

   A. you can never get too much salt.
   B. sunglasses are out of uniform, and unless they are prescription, should not be permitted to degrade discipline.
   C. you must clean the areas of your body that sweat heavily; change underwear frequently, and use foot powder often.
   D. you can't worry about losing a little sleep over night operations when it's cooler.

8. Your brigade requires high-speed reconnaissance over an area of little trafficability. Therefore, you

    A. send out your wheeled scouts because they are best suited for a much higher average speed in poor terrain.
    B. tell the operators to immediately stop engines if a temperature gauge reaches 200 degrees at high speeds.
    C. tell the drivers to open hood panels for better engine cooling during hot weather.
    D. must have alternate ways to communicate, especially if noon is approaching and you start to lose radio contact.

9. In preparing for desert operations, you need to take into consideration what equipment is prone to malfunction. However, equipment that is LESS likely to be a maintenance problem in the desert is

    A. rubber items such as tires which stay preserved better in dry climates.
    B. batteries which actually hold their charge better much like static electricity.
    C. helicopters and tanks.
    D. a U.S. Dodge truck (with a skill driver) made for use on blacktop.

10. Individual training for desert operations includes how to survive. You instruct your troops that

    A. survival training does more than almost anything else to build morale and strengthens self-confidence.
    B. wells in a Middle-East war most likely will be poisoned.
    C. navigation training means familiarization with the celestial arts.
    D. when evading or escaping, get rid of your weapon where it won't be tracked down by the enemy.

11. You are tasked with your unit's training schedule for a field exercise in the desert. For correct advise, you call on

    A. your unit surgeon who stresses his role to minimize casualties, due to lack of consideration of preventive medicine concepts that can far outnumber combat casualties.
    B. Your NBC specialist who emphasizes the need to avoid being uncomfortable in hot environments at all costs.
    C. An intelligence officer who explains how not to waste effort on security after deception.
    D. a communications-electronics NCO who points out special ECCM peculiar to desert operations, such as first interrogating the net for a "hot microphone" during jamming.

12. Your unit is being evaluated in a training mode. You insist on

A. regular close-interval spacing while convoying over open terrain.

B. gunners to expect more first-round hits due to the open terrain.

C. assuming enemy air superiority during all field training.

D. parking all vehicles lined up in a designated parking area away from the TOC.

LESSON THREE

TACTICS FOR DESERT OPERATIONS

OVERVIEW

TASK DESCRIPTION:

In this lesson, you will learn to explain how the desert environment affects deception operations. You will learn how to plan for and explain the methods of employment when conducting operations against the enemy in desert operations. You also will learn to describe tips for fighting in the desert environment.

LEARNING OBJECTIVE:

TASKS:	Explain how the desert environment affects deception operations. Plan for and explain the methods of employment when conducting operations against the enemy in desert operations. Describe tips for fighting in the desert environment.
CONDITIONS:	You will have information from FM 90-3 and Newsletter No. 90-7, Special Edition, AUG 90.
STANDARDS:	Explain how the desert environment affects deception operations, plan for and explain the methods of employment when conducting operations against the enemy in desert operations, and describe tips for fighting in the desert environment in accordance with FM 90-3 and Newsletter No. 90-7, Special Edition, AUG 90.
REFERENCES:	The material contained in this lesson was derived from the following publications: FM 90-3 Newsletter No. 90-7, Special Edition, AUG 90.

INTRODUCTION

This lesson explains how the desert environment affects tactical operations plans and methods of employment against the enemy. The environment of the desert, together with its effects on personnel and equipment requires some modification to tactics and procedures described in other How-to-Fight manuals.

PART A - TACTICAL OPERATIONS IN THE DESERT ENVIRONMENT

Important physical characteristics that influence desert operations are:

- Terrain.
- Lack of both natural and man-made combat service support assets.
- Lack of concealment.
- Excellent observation and fields of fire.

Advantages or disadvantages accruing from these characteristics are equally applicable to an enemy force. This lesson describes how these characteristics influence tactical operations.

1. Objectives.

Objectives are normally dominating terrain from which you can pin down and destroy the enemy. The objective of unit operations in desert warfare is destruction of the enemy. Key terrain features are scarce in many desert areas. Although, they do exist in some areas, such as the passes of the Sinai. Therefore, commanders seldom task units to seize or retain specific terrain features. However, they may need to secure terrain for water sources, routes, or communication sites. Also, units may have to control positions that permit observation even though only a few meters higher than the surrounding area.

2. Mobility.

a. Tactical Mobility. Tactical mobility is the key to successful desert operations. Obstacles and areas such as lava beds or salt marshes, which prevent surface movement, do exist. However, most deserts permit true two-dimensional movement by ground troops similar to that of a naval task force at sea. Speed of execution is essential and requires self contained all-mechanized or airmobile forces with excellent communications.

b. Natural Desert Obstacles. A force may use natural desert obstacles for a defensive position where the enemy cannot turn from either flank. However, these are rare. For example, only five natural defensive positions exist over 3,800 kilometers west of El Alamein in Egypt. In any case, an attacking force capable of airmobile or extended ground operations can usually find a way over or around an obstacle. Then, it can bypass the defending force, contain it, or take it from the rear.

Limited cross-country capability of supply vehicles, (especially that of water tankers or those towing trailers), combined with longer lines of communication, may influence avenues of approach of a large force. The limited hard-surface routes that do exist will be necessary for resupply.

c. Hot Barren Mountains. Use dismounted infantry in areas where terrain, such as mountains, limits vehicle movement, or is sometimes used to establish strongpoints and blocking positions.

(1) Employment of Infantry. Infantry is the basic maneuver force in hot barren mountains. Valleys and foothills can confine mechanized infantry, but their ability to dismount and move on foot enables them to reach almost anywhere. You can use airmobile infantry extensively. Consider modifying the TOE of infantry units operating in barren mountains. You may not need a strong antitank platoon. However, infantry require extra radars and radios for the number of observation posts and separate positions that they may expect to occupy.

(2) Tanks and Armored Cavalry. Hot barren mountains are not a good environment for tank and armored cavalry because they cannot maximize their mobility, flexibility, and firepower.

(3) Mobility and Maneuver. Avenues of approach at ground level are few with limited roads or trails that require extensive engineer effort to maintain. Off road trafficability varies from relatively easy to very difficult. Most movement and maneuver in this type of terrain is by air or on foot. Avoid unnecessary vertical foot or vehicle movement. Rock slides and avalanches, although not as common as in high cold mountains, do exist and can restrict movement.

3. Observation and Fields of Fire.

The normally flat desert terrain permits direct-fire weapons to shoot to their maximum range. However, the desert is not absolutely flat, so position your weapons to provide mutual support like in temperate climates. When preparing defensive positions, you must inspect the positions from the enemy point of view to maximize available cover and concealment. Figure 3-1 shows a poor observation technique, while Figure 3-2 points out an excellent observation technique.

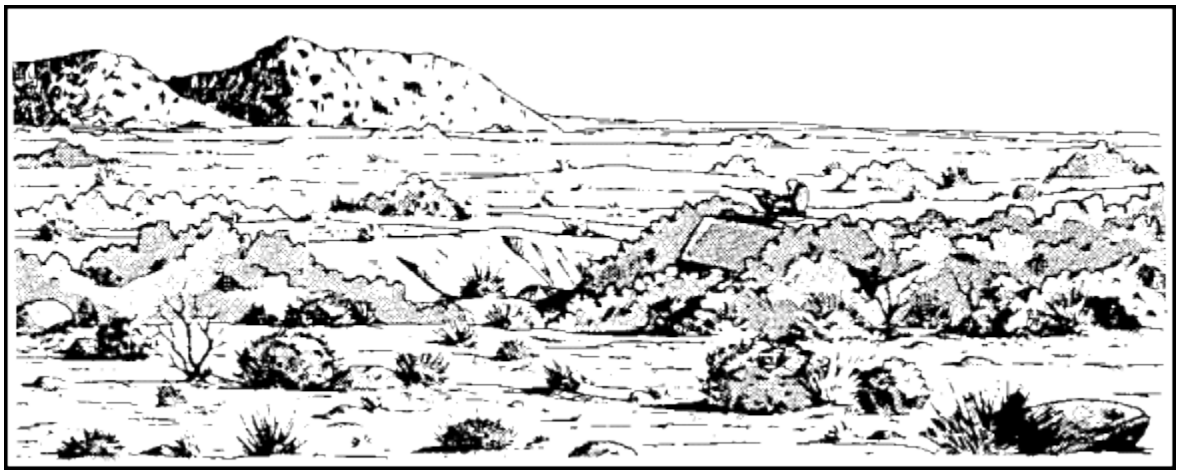

Figure 3-1. Poor Observation Technique.

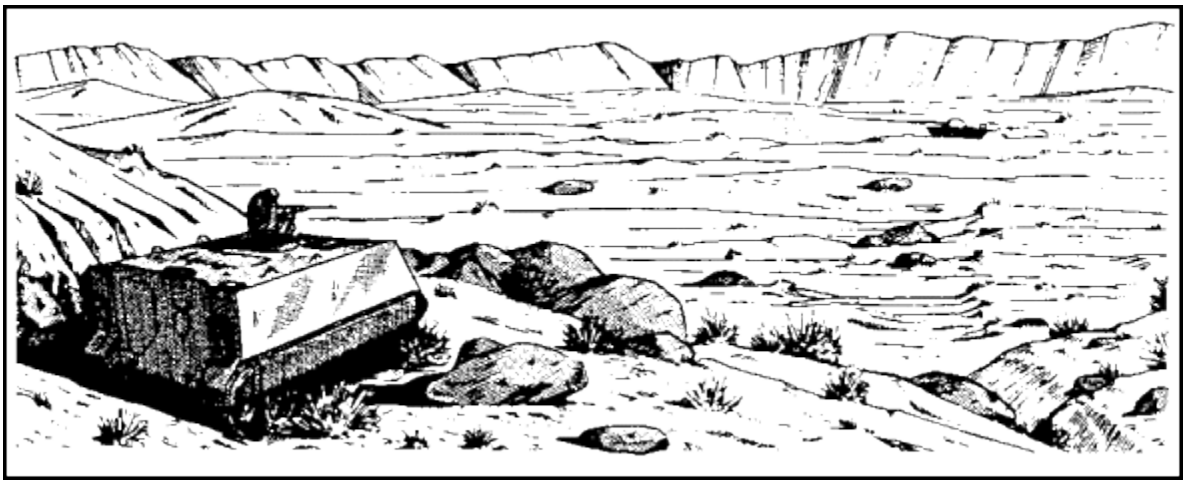

Figure 3-2. Observe From Height If Possible.

a. Visibility. Open terrain and generally clear atmosphere offer excellent long range visibility. However, at certain times of the day the heat may limit or distort visibility. Observation posts on dominant terrain can see dust from helicopters flying NOE from a distance of 20-30 kilometers

and they can easily identify columns of vehicles at more than five kilometers. Often the first indications are flashes from windshields or optics, rather than the accompanying dust column. The ideal observation position has the sun behind it and is as high as possible to lessen the effects of mirage and heat radiation from the ground. When there is no usable dominant terrain available, the only means of observation may be from an aeroscout, or the tank commander may limit your short range observation.

b. Fires. Observation of fires, especially direct fires, may be difficult. High-velocity, direct-fire weapons can throw up considerable dust clouds, and calcium chloride distributed in front of a position also may lessen observation. Burst-on-target corrections may be almost impossible. Crews may have to use flank observers to report elevation and azimuth errors. Dust may hang in the air following the impact of ranging rounds. This may complicate the correction of field artillery fires, especially those of larger pieces. Thus, forward observers should place initial rounds beyond a target rather than short of the target.

4. Maneuver.

Maneuver must be at the maximum tactical speed permitted by the terrain and dust conditions, using whatever cover is available. Even a ten-foot sand dune will cover and conceal a tank. Air defense coverage is always necessary because aircraft can spot movement very easily due to accompanying dust clouds.

To achieve surprise, you must maneuver in conditions that prevent observation-at night, behind smoke, or during dust and sandstorms. It is possible, although difficult, to control maneuver during sandstorms. With favorable winds (supplemented by smoke if necessary), units can attack or maneuver behind a sandstorm. In certain situations, there may be no alternative to maneuver in terrain where the enemy can see at long range. Thus, you maneuver at best speed, while field artillery or close air support aircraft place suppressive fires on suspected enemy positions.

5. Reconnaissance and Security.

Air cavalry, the major reconnaissance means, must guard against ambush by ground troops located at their own altitude or even higher. Security of units must include observation, especially at night, of all avenues of approach including those within capabilities of skilled mountaineers. Consider using remote sensors (REMS) and radar for the security of the unit.

a. Desert Reconnaissance. The desert affords units almost complete freedom of maneuver, with the ability and requirement to see great distances. This requires aggressive and continuous reconnaissance and constant all-round security. Up-to-date terrain reconnaissance is necessary because many desert maps are inaccurate. Use all ground and air means of reconnaissance to the limits of the unit's area of interest. Units seldom employ route reconnaissance, but if required, you must expect to operate over extended distances. Zone reconnaissance is frequent, and zones are normally larger than in temperate climates. Area reconnaissance missions and techniques are unlikely to alter significantly from those in more conventional terrain.

b. Unit Security. Units must always provide for all-round security. When a force is in a defensive position, pay particular attention to all-round surveillance and gaps between units.

The threat of enemy air attack is always present. Therefore, commanders must stress passive and active air defense measures. Ground patrols, radar, sensors, and aerial and ground mounted surveillance devices provide additional means of security at night and during periods of limited visibility. Use passive devices whenever possible.

c. Ground Scouts. Ground scouts normally move two to four kilometers to the front or flanks of leading teams, depending on terrain. They depend on field artillery or mortars, and possibly attack helicopters, for immediate support. This distance allows time for squads to dismount observers and send them forward. Distance also gives the commander time and space to react to their information without inhibiting the movement of their parent unit. Patrols perform most often mounted, dismounting only when necessary to accomplish the mission.

d. Aeroscouts. Aeroscouts flying NOE cannot necessarily find the enemy more easily than ground observers. Stationary targets are the most difficult to see because there is little to draw the observer's attention. Thus, aeroscouts must use caution to avoid blundering into enemy air defense weapons. One method is "dismount and scan." Starting at a distance of five to ten kilometers from the area of interest, the aircraft lands and an observer dismounts and scans the area for suspected enemy. The observer and pilot must remain in contact, using a portable radio. They repeat the dismount and scan process at varying intervals, until they make contact with the enemy.

e. Observation Posts. Position observation post in pairs, as far apart as possible to permit accurate resection. Also place them at different heights to avoid the possibility of dust clouds blocking the vision of both simultaneously. It is best to emplace observation posts by helicopter at night. Drop the observers off at some distance from the designated position. The observers move the remainder of the distance on foot to reduce the chances of enemy observation.

f. Radars. Radars may be valuable during midday heat haze on flat terrain when optical vision becomes hopelessly distorted. Optics are almost useless in sandstorms. Image intensification is of limited value in sandstorms, and at night will depend on the phase of the moon. If there is no moon, you will have to use artificial illumination outside the field of view of the system. Since thermal imagery devices depend on the difference between ambient temperature and equipment temperature, they are more useful at night than in the day.

g. Patrols. Patrols perform mostly mounted, dismounting only when necessary to accomplish the mission.

6. Employment of Army Aircraft.

Army aircraft operate in the desert much the same as in temperate climates, within limits imposed by enemy long range observation and air defense fires. Expect some degradation in aircraft performance due to environmental effects. Although, altitude and rugged terrain slightly inhibited helicopters, you can use helicopter units of all types. Density and altitude will degrade payloads and endurance. Winds are turbulent with considerable fluctuations in air flow strength and direction, particularly on the lee side of mountains. This, combined with terrain, produces extra strain on crews as they have little margin for error. Train flight crews in these conditions before using them for operational flying.

7. Navigation.

Navigation by men on foot is a matter of making best use of available maps, together with the lensatic compass and a pocket altimeter. Air photographs can help, though, you should scale and contour them.

a. Navigation Effectiveness. A force equipped with modern, sophisticated navigation means, can record positions with errors of less than one percent. A force not equipped with such systems may find navigation difficult, depending on the number of visible and known terrain features, and the reliability of local maps. Frequently, you must appoint a person qualified in celestial navigation, in each company team and battalion task force whose primary task is navigation. Thoroughly brief soldiers on the type of terrain and the general environment they will encounter, to include

- water sources, if any.
- landmarks or significant permanent terrain features.
- friendly and enemy areas of operation.
- prevailing winds.

This information will assist reconnaissance units or individuals who become separated from their units, to navigate.

b. Navigation Aids. These vary in sophistication and complexity and may include:

(1) Sun Compasses. As shown in Figure 3-3, you can use sun compasses, as well as sextants, on moving vehicles (both require accurate time keeping).

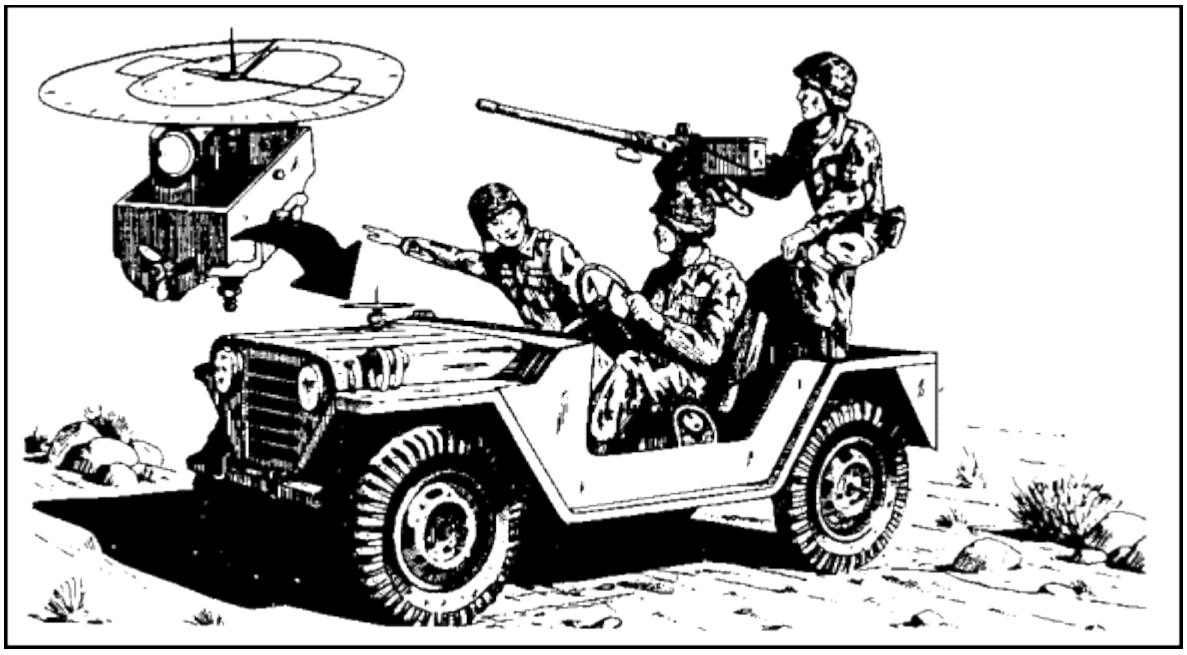

Figure 3-3. Simple Sun Compass In Use.

(2) Lensatic Compasses. On a vehicle, this compass is almost impossible to use with accuracy. It is not reliable near quantities of metal, and underground mineral deposits

can have an effect on it as well. To use the lensatic compass, you must know individual compass error and local deviation.

(3) Gyro Compass. This compass is an efficient gun azimuth stabilizer used on fairly flat ground. It is, in fact, a gyroscope, useful for maintaining direction as it is.

(4) Fires. Planned tracer fire assists in maintaining bearings, and field artillery and mortar concentrations. Use smoke (preferable) or illumination at night to check on estimated locations.

(5) Distance Recorders. It is essential to record distance moved, which may be done by using a vehicle odometer.

(6) RF Beacons. RF Beacons, particularly useful for aircraft navigation, also can permit the enemy to locate friendly forces. You may have to place them in open desert with unit locations marked at certain distances and bearings from them.

(7) Radars. If the position of a radar is known, it can measure range and bearings and therefore position of a vehicle.

(8) Homers. You can use homers in any terrain, although, to a greater degree, they suffer from the same disadvantage as RF beacons.

(9) Aerial Photographs. The advantage of aerial photographs, particularly to aviators, is their ability to show up-to-date views of the variation in color and texture of the desert soil.

(10) Pocket Altimeter. The pocket altimeter is a barometer, measuring height by means of varying air pressure. If a navigator can establish his location in the horizontal plane by resection on one point, the altimeter tells him his height and thus his exact position. Since fluctuations of air pressure affect the instrument, you must reset it at every known altitude.

(11) Lights. Pilots may have difficulty navigating at night, especially if several aircraft are operating in the same area. It may be necessary to provide aircraft with hooded rear facing navigation lights. Troops on the ground can assist aerial navigation with visual communication, such as lights in varying quantities, patterns, or colors. You also may need radio beacons placed on the highest available ground.

8. Identification.

Identification Friend or Foe (IFF) is a problem for ground troops and even more difficult for aircraft. National identifying marks are not sufficient, so you need to have a thorough knowledge of the vehicles used by both the enemy and allied forces. The force should have a standing IFF operating procedure that allows for daily changes. You can use systems that include:

- Tape markings, white or multicolored.

- Colored pennants in different daily positions. Don't fly these from antennas as they may degrade radio performance. Unless all vehicles carry them, they may assist the enemy to identify headquarters vehicles. They may be of negligible value in very dusty conditions.
- A commonly known radio frequency for IFF only.

9. Communications.

a. Wire. Maneuver units are unlikely to be in one place very long, so wire communication are not extensively used, except in rear areas. If you use wire, bury it to a minimum depth of 12 inches to avoid damage from track vehicles or shell fire. Keep plenty of slack in the line to allow for sand shift. Keep accurate map plots of buried wire. If you must use overhead wire, mount it on posts erected in the form of tripods to avoid falling during severe wind storms. Blowing sand can damage insulation, so continued maintenance is necessary.

b. Radio. Radio is the primary means of communications in desert operations due to speed of movement and distances involved. You may need to use air or ground relays during the hottest periods of the day as VHF (FM) radios can have their range degraded by as much as 50 percent.

Some areas of desert are "dead spots," usually due to certain minerals below the surface. These areas are unacceptable for command posts. You must establish communications with all subordinate units from a newly selected position before headquarters moves from the old position.

c. Liaison Officers and Messengers. Use air or vehicle mounted liaison officers or messengers if units are stationary or under listening silence. They should be proficient in navigation and equipped to destroy the message if liable to capture.

d. Pyrotechnics and Sound. Pyrotechnics are usually more effective in temperate climates. Although, heat mirages and dust storms may impair or restrict their use. Heliographs (signal mirrors) may be useful because they are directional and aid security. Sound communications are usually impractical due to distance, vehicular noise, and storms. Yet, you can use sound for local alarm systems.

e. Visual Signals. You can use colored flags with prearranged meanings as a means of communication in the flat open terrain of the desert.

10. Electronic Warfare.

Electronic warfare is important in all environments, but is particularly important in the desert for the following reasons:

- Radio systems are by far the most important means of communication and the most susceptible to jamming or monitoring. You may find it more difficult to position antennas where they will efficiently cover the area of friendly forces yet will not radiate to the enemy.
- Some of the other means of intelligence (civilian population or prisoners of war) may not be useful because of scarcity, or their information already is out of date due to the inability and speed of the forces employed.

The appropriate How-to-Fight manuals describe the electronic warfare measures that each level of command can take.

11. Tactical Deception Operations.

Division or corps normally plan large scale deception operations. However brigade level, or lower, may employ operations of short range and intermediate effect to achieve tactical advantages. Execution of large or long-range operations normally is centrally controlled. This helps prevent friendly units from blundering into deception efforts such as dummy positions, minefields, or specially-constructed installations. Individuals and units contribute to the deception effort by maximizing OPSEC to prevent alerting the enemy to our real operations.

The use of deception depends very much on timing. You must allow sufficient time for the deceptive information to sink through the enemy intelligence system for his maneuver units to react. On the other hand, too much time may allow him to see through the deception, thereby ruining the whole plan. Described below are certain deception techniques that you can use in desert warfare.

a. Dummy Installations. Preparation of dummy installations can conceal operational plans to deceive the enemy about the real location of potential targets, such as POL dumps or railheads. Camouflage dummy installations and protect them with a few air defense weapons. Otherwise, the enemy will suspect that they are phony. You can ignite flammable material after an attack to simulate damage. Also, you can simulate activity by varying locations and sizes of dummy supply stocks daily and by varying wheel tracks at intervals to simulate vehicular activity.

b. Damage Simulation. You can simulate damage to induce the enemy to leave important targets alone. Paint ragged patterns with tar and coal dust on the walls and roof of a building and place covers over them. Stack debris nearby and wire any unused portions for demolition. During an attack, remove covers under cover of smoke generators, scatter debris, and blow demolitions. Enemy air photography will subsequently disclose a building too badly damaged for use. Soldiers using the building after an attack must guard against heat emissions after dark and then must take care to control electromagnetic emissions.

c. Phony Minefields. Use phony minefields to simulate live fields.

WARNING

DO NOT EMPLACE LIVE MINES IN A PHONY MINEFIELD.

Disturb the ground so it appears that mines have been emplaced. Mark boundaries with appropriate warnings. Don't allow any personnel or vehicles into the minefield area. You can camouflage or make a real minefield appear phony. Once you settle a real minefield, run a wheel or a specially-made circular wooden tank track marker through the field, leaving track or tire marks to lure the enemy on to live mines. Do not sow antipersonnel mines in such a field until you have laid the track marks. Another method is to leave gaps in a mechanically laid field, run vehicles through the gaps, and then close them with hand-laid mines without disturbing the track marks.

d. Decoys. Use decoys to confuse the enemy about the strength of friendly forces and unit identity. Conceal unit movement by positioning decoys after the real unit has moved. The

degree of accuracy necessary depends on the range of enemy surveillance, but use some metal in each model to produce heat emissions in the cooler hours. Also, you can include a few electromagnetic sources to deceive electronic support units. Move models at intervals so they are not in the same position on successive air photographs.

(1) Stationary Vehicles and Aircraft. Build stationary vehicles and aircraft using lumber, burlap, paint, and parts of destroyed equipment. Use sophisticated flexible foam rubber models, If available. Make vehicle tracks entering or exiting decoy positions, as appropriate, to deceive photographic interpreters.

(2) Mobile Decoys. Mobile decoys serve the same purpose as stationary decoys. They have the advantage of being more lifelike and the disadvantage of requiring more labor and personnel. Use mobile tank decoys constructed on support vehicles to cause the enemy to

- believe friendly forces are attacking or withdrawing.
- conceal the fact that a real unit has moved.
- or give an exaggerated idea of tank strength.

Also you may camouflage real tanks as support vehicles.

(3) Field Artillery Decoys. You can construct field artillery decoys in the same manner as described above for mobile decoys. Due to enemy target acquisition capabilities, you can also simulate fire by flash or sound ranging. If simulators are not available, suspend explosive charges one meter from the ground and detonate to simulate field artillery fire. If the explosives fail to give enough flash or detonation, you can also use photoflash, filtered to the appropriate color. Confuse the enemy about the location of the real firing unit by simulating fire when the real field artillery fires.

(4) Counterfire Intelligence. You may get counterfire intelligence from dummy positions if the enemy returns fire. Inform division artillery. Personnel manning dummy artillery positions should have foxholes for protection from counterfire.

(5) Decoy Unit Positions. Place decoy unit positions carefully. Do not make them unusually obvious. Place them in locations where the enemy would expect to find a unit of the type copied. Dig shallow fighting positions to represent infantry positions. Make them approximately one foot deep and filled with brush to deepen the shadow and give them an illusion of depth. They also must give a camouflaged impression and have overhead cover. Constant maintenance is necessary. Like decoy vehicles, there must be some form of activity simulation in the area.

e. Noise. Use noise to create a false impression of strength or movement, or to lure an enemy force into an area where fires can be concentrated against them. Noise, particularly effective at night because it carries farther, is affected by wind strength and direction. You also can record noise. For example, a line of powerful tape recorders can easily simulate a column of tanks or helicopters on the move, but it is essential that the amplifier hum is not heard. Deliberate natural

noise (the clang of a dropped can or a closing tank hatch) can easily be overdone by constant repetition, possibly producing a situation quite different to that intended.

f. Dust. You can take advantage of the normal dust column raised by movement. Make a fake helicopter landing zone, equipped with decoy aircraft. Make it more realistic by having a jeep tow chains between the "aircraft," giving the impression of aircraft hovering close to the ground. A few real aircraft flying NOE can give the impression of much activity.

12. Special Operations.

Because desert operations involve wide areas, you can usually find gaps in enemy defenses that small units can slip through to conduct raids, sabotage installations and pipelines, gather intelligence, and effect liaison with friendly irregular forces.

a. Mission Factors. In addition to the mission, consider the following factors before conducting a special operation:

- Local natives, attitudes, possibilities of support (including guides), languages spoken, payment.
- Cover plan to divert suspicion from local inhabitants.
- The terrain cover, course to follow to and from the objective, maps and air photographs available.
- Method of entry and exit. The return route should be as different as possible from the initial route.
- Climatic peculiarities expected.
- Size of the force.
- Air support.
- Supplies the force must carry, methods and locations of prestocking and resupply if any.
- Medical support.
- Special equipment and weapons.
- Communications.

b. Personnel. Select personnel for special operations with the utmost care. Officers should be

- ranger qualified.
- experienced in different desert terrain.
- able to speak the local language.

If not, officers, and when practical, similarly qualified enlisted men, should have considerable training in living off the land away from civilized communities.

Each member of the team must be a skilled driver with experience in desert terrain and an expert on all appropriate types of small arms. A significant number of the group must be capable of operating all of its communication systems. A smaller number should be qualified in first aid. You also must include mechanics. Some personnel must be proficient in dead reckoning and celestial navigation by day and night. All must be physically fit.

Personnel who have the technical training described above, can gain special operations training by trips into the desert, held by friendly troops. These teams require over 1,600 kilometers of experience across unmapped featureless terrain before they will be ready to operate against the enemy in his own territory.

c. Teams. Use fully mounted teams. Keep the number of vehicles small to minimize the probability of mechanical malfunctions and bogging down. Light, simple cargo vehicles are favorable to track armored vehicles, which are complicated to repair and use too much fuel.

Infrequently, teams can parachute in, fly in by helicopter, or move in by boat or submarine if the objective is near a coastline. Helicopters are not advisable for general use in special operations. They are extremely difficult to hide and use large quantities of fuel, although, they have the advantage of speed.

d. Supplies. Carry sufficient rations, ammunition, fuel, and water so the team can perform as a self-contained unit for the operation. Weigh each item out to the pound. Limit water, due to its weight and volume, to the medically-advised minimum according to the environment. You will require extra water for radiators. Equally load all vehicles. Daily consumption will lighten each truck load so limited overloading is permissible at the start, especially if the first few days of the operation are over trails or known areas. Although, you can prestock items in certain locations before or during an operation, this should be rare because it may compromise security.

e. Weapons. Choice of weapons to carry will depend on the mission, but at least arm all vehicles with a mounted machine gun. You also may include heavy and light antitank weapons and shoulder fired air defense weapons.

f. Radios. You will need radio communication between vehicles and with the force headquarters that directs the operation. Radios should be capable of operating from vehicle or dry batteries. Within the team, communications should normally be by voice, or hand, or flag signals. Although, you can use flares or radio in an emergency. Send messages from higher headquarters on a variable frequency and time schedule. Don't require the team to reply except in extreme circumstances.

g. Movement. Move mostly by night; it is cooler and easier to navigate. Rest crews under camouflaged vehicles during the day. If attacked from the air when stationary, personnel not manning vehicle-mounted air defense weapons should scatter from the vehicles, which will be the main targets. As a first priority, remove the water supplies from any vehicles hit by enemy fire.

h. Surprise. On arrival in the objective area, spend the maximum available time on reconnaissance. The team must rely on surprise to achieve its mission.

13. Combat Support for Desert Operations.

A force operating in the desert must be capable of meeting any known or foreseen weapons system. It must be a balanced force with combat support and combat service support. It must be a combined arms team. Although, you find principles of combat support operations in How-to-Fight manuals dealing with a specific arm or service, there are some techniques you must modify or emphasize in the desert.

a. Field Artillery. You must provide close and continuous field artillery support for all levels of the force, due to the fluid nature of desert operations and the possibilities for excellent enemy observation. Field artillery pieces must be at least as mobile as the force they are supporting. Crews must be proficient in direct fire and prepared to defend against a ground attack.

(1) Rapid Displacement. Due to the threat of immediate counter-battery fire, field artillery units must be ready to move into position, fire, and rapidly displace to another position. A battery should be prepared to displace several times per day.

(2) Survey Devices. Equip field artillery units employed in desert operations with the most sophisticated survey devices available. Manual systems are slower and less accurate, thus affecting tactical employment and reducing response time.

(3) Observation Posts. Emplace field artillery observation posts on the highest available ground. In low cloud conditions, stagger them in height. Predicted fire may be inaccurate due to rapidly changing weather conditions, making observed fire a more sure method for achieving the desired results.

Enemy air defense may make aerial observation extremely difficult, so ground observers make most adjustments of fire. Weather conditions can change rapidly in the morning and evening (and occasionally at other times of the day), affecting the accuracy of fires. Therefore, you must recompute weather corrections frequently.

(4) Gun Positions. It may be difficult to find good gun positions at lower altitudes due to crest clearance problems, so operations often use high-angle fire. The best weapons are light field artillery and mortars. They are airmobile and troops can manhandle them into positions as high as possible.

b. Air Defense Artillery. Because of the wide open spaces characteristic of many deserts of the world and the large areas associated with desert operations, you should reinforce desert fighting forces with more than the normal complement of air defense weapons. Still, you may not have enough dedicated air defense systems to fully cover the force. When this is the case, commanders must be especially careful when establishing air defense priorities in view of long lines of communication and the tendency to maneuver over large areas. In any event, all units must include a scheme for countering air attack in their battle plans. This requires both active and passive measures.

Armored and mechanized infantry division air defense weapons generally mount on tracked vehicles. However, this does not necessarily apply to corps medium altitude air defense units. Nevertheless, corps surface-to-air missile (SAM) units have considerably greater ranges, and have more sophisticated

early warning and control systems. Thus commanders should employ some corps units well forward. These weapons will have to displace by section to ensure continuous coverage.

Automatic weapon units have limited range and require careful control of ammunition due to their high cyclic rates of fire. They are, however, extremely versatile, so you may employ them in direct-fire ground support roles if necessary. They are useful when employed with highly mobile forces and they can deploy very quickly in their planned air defense role.

Locate air defense artillery units close to elements of supported units to provide for ground defense. When the supported unit moves, the air defense unit also must move, which requires careful coordination so as not to delay the supported unit.

Like field artillery, self-propelled weapons in this environment, have limited use. Although, you may use some in valleys. Airmobile towed weapons allow employment throughout the mountainous area of operations.

> c. Engineers. Construction, improvement, and repair routes, and their denial to the enemy, is a major task for engineers, even in an airmobile force. Mining is important due to the limited number of routes. To overcome the problem of flash floods, lines of communication require constant drainage, and possibly bridging.

Engineer operations in the desert are similar to those in temperate climates. Although, you have to cross fewer natural terrain obstacles. Depending on the terrain anticipated in the operations area, you may have to obtain a dry-gap crossing capability from corps support units. Important tasks for engineers in desert operations include:

- Finding, developing, and if necessary destroying water supplies. This is a high priority task.
- Map making.
- Construction of obstacles.
- Construction of logistic activities and routes.
- Construction of field fortifications.
- Construction of airfields and helicopter landing pads.

> (1) Development of Water Supplies. Water supply is the single most important mission of engineers in the desert. The search for sources requires continuous, intensive reconnaissance. Engineers may obtain water by drilling beds of dry water courses, or by deepening dry wells. Once water is found, make it potable for storage or transport. Water purification trucks may be high priority targets, and barely enough for the task. So, augment any force operating in the desert with water supply units, including well drilling, water purification and water distillation teams, and transportation.
>
> (2) Destruction or Denial of Water Supplies. Destruction of enemy water sources can reduce his efficiency to a degree that he becomes militarily ineffective. Known sources and targets such as pipelines are priority targets for air attack. In retrograde operations, friendly water sources may be mined, booby-trapped, or contaminated (a distillation of

old animal bones can be used). Poison is forbidden by the Geneva Convention. Exercise care to ensure no one takes action that would deny water to friendly forces. Also, you must consider the political impact on the local population of water source destruction or denial before you make the decision to do this. In any case, you should not destroy water sources without approval of higher headquarters.

(3) Map Making. Maps of any useful tactical scale do not cover large areas of the world's deserts. The maps that exist are frequently inaccurate, increasing the difficulties of navigation. Therefore, engineer topographic companies need to augment the force to prepare, print, and distribute up-to-date maps of the operational area. They can use USAF and Army aviation support to produce grid maps from aerial photography of the area forward of the line of contact.

(4) Obstacles. Due to the mobility inherent in desert operations, obstacles must be extensive and used in conjunction with each other and any natural obstacles. You can easily bypass isolated obstacles.

(5) Mines. You can easily emplace mines in a sand desert where blowing sand will effectively conceal evidence of their emplacement. However, you must consider the following potential problem areas:

- For effectiveness, you need a large number of mines.
- Sand can cause malfunctioning.
- Shifting sand can cause mine drift.
- An excessive accumulation of sand over the mines can degrade performance.
- Sand may be blown away, thus exposing the mines.

(6) Antitank Ditches. In suitable terrain, use antitank ditches that exceed the vertical step of enemy main battle tanks. Because you cannot conceal antitank ditches, you must dig them so they do not outline a defensive front or flank. They have the advantage of not requiring as much logistic support as mine fields. You must cover them by observation and fire to prohibit enemy infantry using them as ready-made trenches.

(7) Construction of Logistic Activities and Routes. Because of the limited off-road mobility of most combat service support vehicles, considerable engineer effort may be necessary to construct and maintain routes forward to maneuver units. Use local resources, such as ground or salt marsh mud laid on sand. Track vehicles should not use these routes since they could easily tear them up.

d. Combat Intelligence. The importance of intelligence sources may differ from what you expect in more conventional areas. You must interrogate prisoners of war immediately because the flexibility of operations will rapidly make their information out of date. You encounter very few civilians in desert operations. Therefore, unless you can corroborate it, treat any information they give, with caution. Military intelligence teams located in the area of operations can determine if these PWs and civilians are in fact what they say they are or infiltrators sent to

harass the rear area and commit acts of sabotage. Electronic support measures are a major source of intelligence in desert warfare. Enemy activity, or the lack of it, is a good source of information. Punctual, accurate reports by all sources, both positive and negative, are necessary.

e. Military Police. Military police will continue their combat support well forward in desert operations, although over increasingly extended distances. Of special importance will be MP tactical and physical security over extended lines of communication such as petroleum pipelines and viaducts transporting water over long distances. The importance of these items demands both active and passive measures, including overflight by returning aircraft or overwatch by convoy movements. You must augment security at storage sites for water, food, POL and ammunition, which historically have been principal targets of enemy action. The indefinite conditions and number of roadways will require increased control points to direct traffic, redirect stragglers, and provide information to expedite movement forward to the fighting elements.

Military police are especially valuable when the combat commander must employ concentration and economy of force in the face of the enemy to gain a favorable combat ratio. MP's can secure the roadways, enforce priority movement, and prevent delay of elements undertaking passage to blocking or defensive positions.

Because of the frequent interdictions of mountainous roadways, military police will experience multiple defile operations. They must employ temporary traffic signs to expedite traffic movement to the front. Expect the number of stragglers to increase in this environment. Because of difficulty in resupply, the supply points for water, POL, food, and ammunition will become especially lucrative targets for enemy attack. Rear area security elements of the military police must develop plans for relief and augmenting base defense forces.

f. U.S. Air Force support. You can expect USAF tactical fighter bomber and airlift aircraft to support a U.S. Army force fighting in the desert. Close air support by USAF tactical fighter bombers is most important in desert warfare because of lack of concealment, large areas of operations, and mobility of forces employed by each side. In the desert environment, air forces can locate targets easier because visual observation normally is far superior to that in temperate climates, and ground movement is more readily apparent. Lack of covered approaches, may handicap air attacks, but increased visibility permits engagement from standoff ranges. When flying close air-support missions, pilots must be able to differentiate between enemy and friendly forces. Use panels or other visual or electronic identification means to assist in identification.

Because commanders will likely use extended lines of communication in desert operations, they should use USAF theater tactical airlift whenever possible. This is particularly true of resupply operations conducted over considerable distances from a lodgement area to forward trains areas.

Planning for air support must be as detailed as time permits to determine mission and armament requirements, time over target, and method of control. Use the joint air-ground operations system (AGOS) to request and coordinate the use of U.S. Air Force tactical air support.

g. U.S. Navy Support. When U.S. Navy gunfire, or Navy or Marine aircraft support the force, elements of a Marine air and naval gunfire liaison company (ANGLICO) are attached to the Army ground forces. The mission of the company is to support an Army division by providing control and liaison agencies for the employment of this support.

Platoons and teams can advise commanders on capabilities, limitations, and employment of naval gunfire and USN or USMC air support. Normally, you place platoons with brigades or higher headquarters, and place air and gunfire support teams with battalion task forces. Although the company has organic vehicles and some combat service support capability, its elements generally require some additional administrative and logistic assistance from the supported unit. You also may have to provide additional communications equipment to net with Army units.

14. Combat Service Support.

Supply of water and ammunition and the evacuation of wounded, especially if helicopters cannot land, can complicate operations. Unit or civilian porters may have to transport water and ammunition using A frames or other suitable devices, or even animals such as camel or mule. Lines of communication can be vulnerable and supply speed slow because of distances between units. Except for class V and sometimes class III, resupply should be at night for security. When planning a desert operation, consider the following factors.

a. Water. A great demand for water can tie down quantities of transport and may involve laying pipelines. Water is vital, so every operation estimate must consider the water situation. Water carries a higher priority than food. Demand for water is about nine quarts per day per man as a minimum and sometimes more. Soldiers should carry three canteens and every effort should be made to prestock water in positions or along routes.

b. Transportation. Air transportation provides the best mobility in mountain operations. However, weather, enemy activity or scarcity of landing sites may limit air transportation, so there should be an alternative means available. Terrain permitting, use high mobility wheel vehicles off main routes and as far forward as possible. Beyond the limits of wheel transport, you may have to use animals (which may need acclimatizing) or porters, as an alternative.

c. Employment of Trains. Brigade trains should locate near an airstrip that can handle USAF tactical air lift. These trains are an obvious target for enemy air attack or artillery, or raids by enemy deep patrols, so you must have adequate air defense and a coordinated area defense plan in place. You must place guards on all dominating terrain around the area. Equip them with ground surveillance radars and STANO devices. Also, you should employ patrols outside the perimeter.

d. Supply. Essential mobility and freedom of tactical maneuver tie entirely into the ability of the logistic chain to supply maneuver units. Two alternatives are available: increase the rate of supply, probably requires more vehicles, or prestock, which ties units to the stocked area. Supply points may be set up in the brigade trains area to operate distribution points for class I, III, and V. However, where you have limited routes, you may need to resupply totally by air from the DISCOM area.

The variations in demand of supplies from those in temperate climates are very much the same as those on a desert floor. Some important supply considerations are:

(1) Class I. It is often impractical to supply hot rations from mess trucks, especially when the unit is subject to enemy air reconnaissance or target acquisition devices. Feeding from canned combat rations is the usual method of troop feeding. Mess trucks are not practical in this terrain. Either eat food cold or use can heaters. Each soldier should carry one day's emergency ration in case the daily resupply does not arrive.

(2) Class II. There is a high demand for footwear. Expect combat boots to last approximately two weeks in the harsh rocky terrain.

(3) Class III. Expect daily requirements for POL in desert operations to be high. Estimates for POL requirements should consider large scale maneuver inherent in desert operations. Individual vehicle consumption will be greater than normal. Aircraft fuel requirements are greater, but it should be possible for much of their refueling and servicing to take place well to the rear where resupply is easy.

(4) Class V. Estimates of ammunition requirements should reflect the heavy level of commitment that you can anticipate in desert operations.

e. Maintenance. Heat, sand, and dust damage to equipment requires increased maintenance. This not only increases the repair workload, but also increases demand for replacement items due to increased wear.

Disabled vehicles are vulnerable targets. Conceal them as well as the maintenance vehicles used in working on them. Impose strict light and sound discipline at night. Use maintenance contact teams carrying class IX supplies with quick turnovers.

f. Health Services. First aid at squad and platoon level is very important because corpsmen may not be able to reach individual isolated positions. It is easy to lose casualties in this terrain, so a buddy system to keep watch on each other should be a matter of SOP. Medical evacuation is mostly by air. It is a comparatively long distance to the nearest helicopter landing site, so you will require teams of stretcher bearers.

g. Evacuation of Sick and Wounded. Long limited routes and the absence of facilities, such as water, along them, complicate medical evacuation. For these reasons, commanders should opt for evacuation by helicopter. Medical units and evacuation vehicles will require greater quantities of intravenous fluids than they would carry in temperate zone operations.

15. Command and Control.

The commander controls operations, using a highly mobile command group located well forward. He personally directs the battle, but must not be drawn into personally commanding an isolated segment of the force to the detriment of the remainder of the command.

As previously mentioned, dry desert conditions can sometimes reduce radio signal strength and create unforeseen blind spots, even in aircraft operating nap of the earth. If there is any possibility of a commander losing contact with some elements of his command for any length of time, he should

operate where he can maintain contact, at least with forward units in critical spots and with his tactical operations center.

PART B - PLANS AND METHODS OF EMPLOYMENT AGAINST THE ENEMY IN DESERT OPERATIONS

Enemy forces operating in the desert are mostly armored, Featuring many tanks, infantry armored fighting vehicles, self-propelled field artillery, air-defense artillery, and other mobile supporting forces.

Enemy forces have a complete array of individual and vehicular protective gear for operations in an NBC environment. Most armored vehicles feature positive protection for vehicle crews when closed down. Enemy forces train extensively for operations on a nuclear battlefield.

Enemy forces can conduct effective electronic warfare operations, including radio interception, jamming, direction finding, and countermeasures to systems similar to their own. You can find threat force equipment and tactics described in How-to-Fight manuals appropriate to each level of command. The following paragraphs describe enemy tactics in the desert.

1. How the Enemy Attacks.

The enemy avoids frontal attacks in the desert. Yet, he will do so if it enables him to hold a defending unit in place while other units maneuver to take advantage of an uncovered flank or gap. He will most often try to attack from one or both flanks, or from the rear. Objectives, deeper than in more conventional terrain, may be airfields, mountain passes, water points, or other key features. Frequently, ground forces attack to link up with parachute or airmobile troops that have completed such missions. Ground forces also attack to cut main supply routes or, destroy combat service support installations. Figure 3-4 illustrates how the enemy conducts attacks on a wide front.

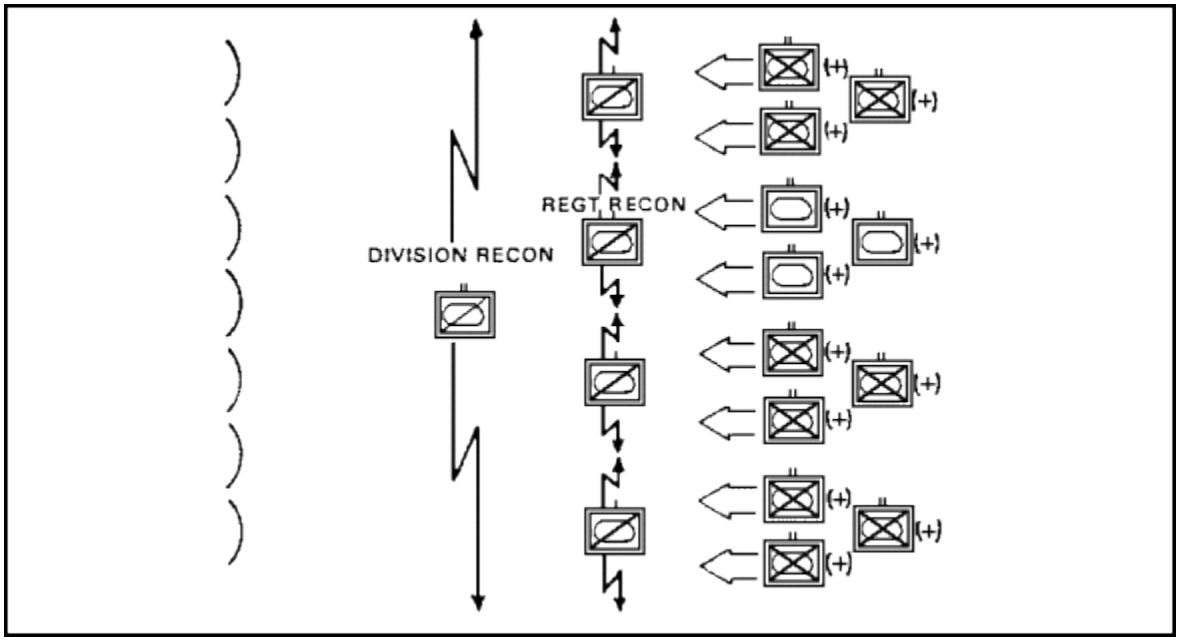

Figure 3-4. Threat Division Frontal Attack.

There may be gaps between companies of a battalion, battalions of a regiment, and regiments of a division. A division may attack in a single echelon. Although, each regiment may maintain a company in combined arms reserve. When a motorized rifle division attacks in two echelons, the tank regiment is likely to be in the first echelon. Regiments and battalions are given more freedom to maneuver than normal, as shown in figure 3-5.

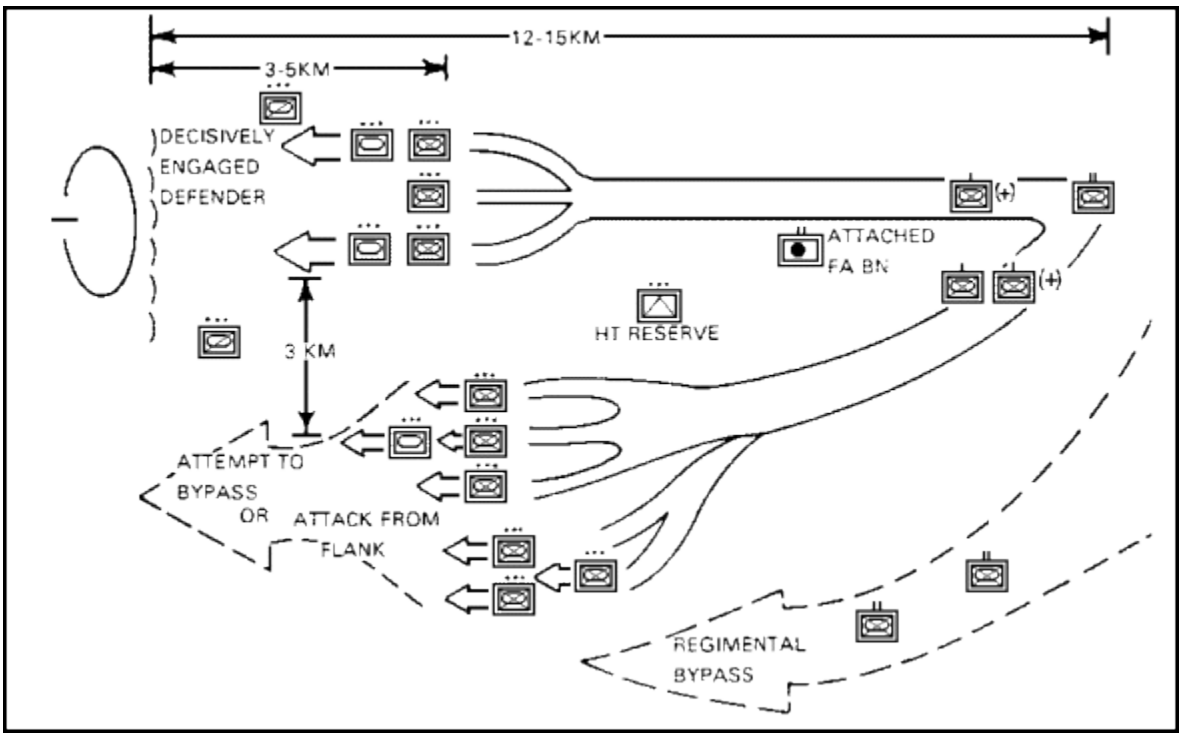

Figure 3-5. Threat Regiment Hasty Attack.

The attack emphasizes speed. Note the direct, deliberate attack illustrated in Figure 3-6. The enemy frequently uses smoke, including dummy screens, to confuse the defender about the actual direction of his attack. Movement will frequently be at night using active and passive night vision devices. Some vehicles have gyro compasses for navigation. Formations depending on them will vary their direction of movement as little as possible so they will not become disoriented. Infantry may dismount and infiltrate to achieve surprise, with tanks and infantry carriers providing a base of fire and joining them after the attack has started. Combined arms teams are as logistically self-sufficient as possible, especially for water.

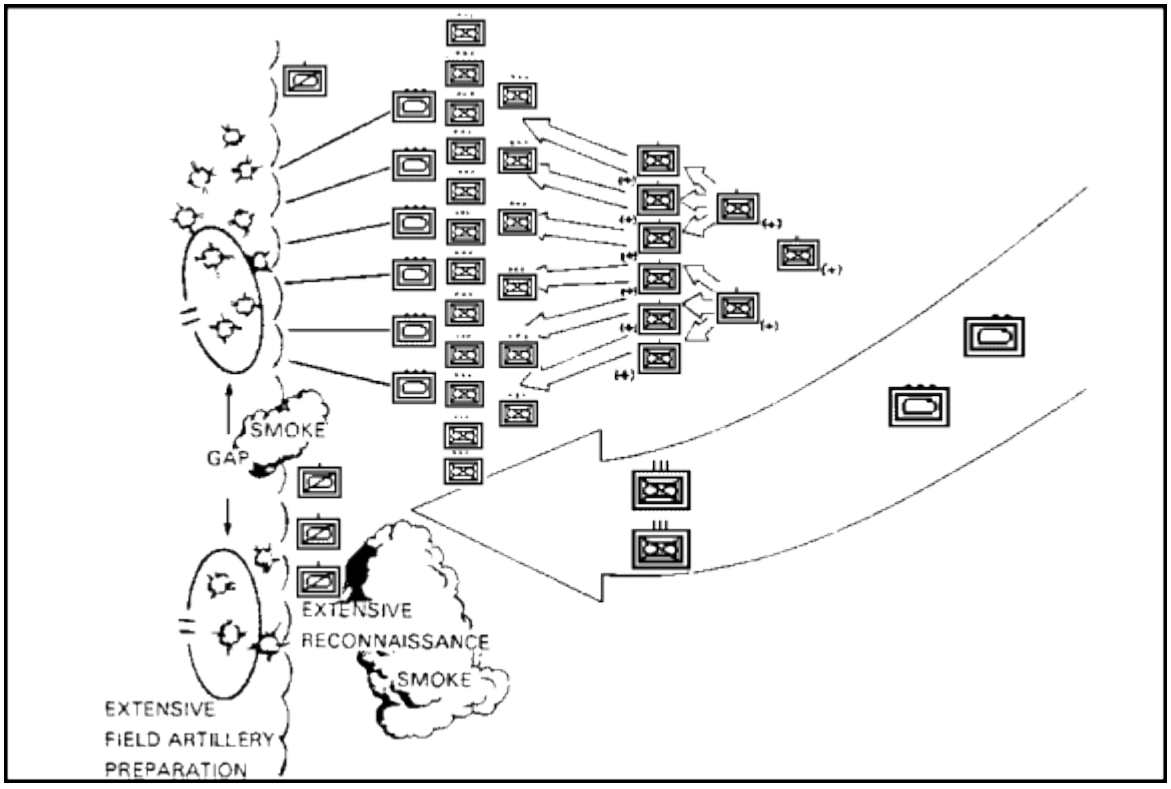

Figure 3-6. Threat Division Deliberate Attack.

a. Meeting Engagement. Following a movement to contact, enemy forces expect meeting engagements to be most often decisive in desert warfare. Figure 3-7 shows an enemy regiment moving to contact. The enemy plans meeting engagements against resistance met during movement, while he uses breakthrough attacks against forces that he cannot defeat directly after he makes contact. A battalion moves in column until division and regimental reconnaissance elements locate the enemy. Due to longer observation and fields of fire of the defending force, the battalion deploys into company columns approximately 12-15 kilometers from the defenders, and into platoon columns 3-5 kilometers from the line of expected contact.

The forward company engages the defenders to pin them down, and provides supporting fires while the remainder of the battalion moves out to one flank or the other, and either attacks the defenders from that flank or bypasses the position. This maneuver may be up to three kilometers from the original avenue of approach. If the battalion cannot outflank the defense, it continues to maintain frontal pressure while the remainder of the regiment extends the flanking maneuver.

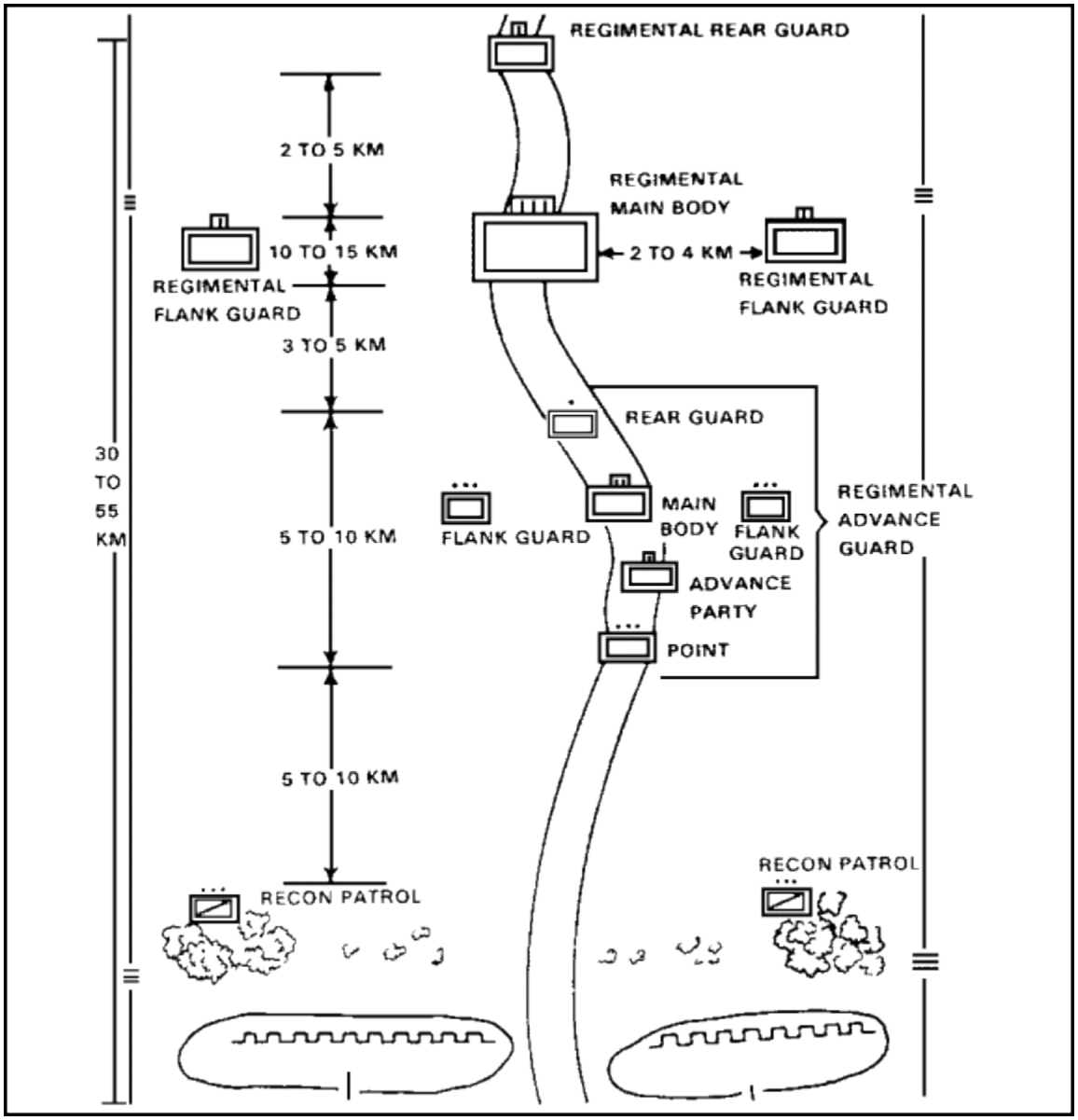

Figure 3-7. Threat Regiment Moving To Contact.

To reduce the risk of counterattack, antitank reserves, regimental mine-laying detachments, smoke, and possibly attack helicopters, cover such movements. The division artillery group deploys in support when the lead regiment is committed.

b. Breakthrough. The enemy mounts the breakthrough against well prepared defensive positions or when a meeting engagement has been repulsed. A regiment also uses it to engage a defender while the remainder of the division maneuvers to attack from the flank or rear. The breakthrough involves larger forces, takes longer to prepare, and has a greater weight of fires than a meeting engagement.

Since previous reconnaissance had been unable to locate gaps or weak points in the defensive positions, the enemy will orient the reconnaissance effort to gain maximum information on the breakthrough area, including artillery locating systems, radar, and radio intercept systems. The attacker normally chooses

an avenue of approach with best trafficability and ease of navigation. When two avenues exist, the enemy makes a major effort along one. Units on the other conduct a supporting attack at a time that diverts attention from the main effort. Each avenue used by a division is normally 4-10 kilometers wide, depending on available artillery, with two regiments on one and one regiment on the other. You can support the forces on the main avenue by massive artillery, including mortars, multiple rocket launchers, antitank guns, and indirect tank fire (where necessary) for up to 100 tubes/km of breakthrough frontage.

Divisions normally have assembly areas about 20-30 kilometers from attack positions. Units normally move forward from dispersed areas in march column and break into company and platoon columns at the same distances they would use for a hasty attack. Heavy artillery preparatory fires will start at approximately the same time as battalions break into company column. These fires normally last between 25 and 50 minutes. The enemy makes nuclear or chemical strikes, if used, immediately before conventional preparatory fires.

Tanks usually lead the assault, with infantry carriers supporting them with main or secondary armament 100-400 meters behind. Unless resistance is exceptionally strong, infantry are unlikely to dismount. An enemy uses mine plows and rollers if necessary, with platoons moving through minefields in column. When the enemy cannot clear obstacles mechanically, this may force the infantry to dismount along with supporting engineers, to clear lanes for armored vehicles.

Commit the second echelon, if any, to maintain pressure on the main avenue of approach when the momentum of the attack slows. As soon as it makes contact, the enemy forms a combined arms reserve from bypassed first echelon units, while the remainder of the first echelon, if still effective, continues to advance. A unit that has successfully broken through the defense often moves ahead of its parent unit to destroy deeper positions or seize deeper objectives. Such tasks are often undertaken with airborne or air-transported troops.

c. Parachute and Heli-borne Operations. An enemy extensively uses airborne and air-transported troops, especially at night. Airborne troops are not often committed within brigade area except in support of nuclear strikes. They usually are used on much deeper objectives, for example, a lodgement area. Operations by air-transported troops, using HIP and HOOK and supported by HIND-A attack helicopters, are frequent. The normal force used on such operations is a battalion, or occasionally a larger unit, from a second echelon motorized rifle regiment. A motorized rifle battalion usually gets transported with its organic vehicles and mortars. Likely missions are

- destruction of critical installations.
- securing water sources.
- blocking movement of reserves.
- destroying command posts.
- seizing defiles.

Helicopters, in flat desert terrain, are vulnerable if in range of ground defenders, so they may make a wide detour around a flank. Ground forces attack in order to link up within 48 hours after the operation starts. Until linkup occurs, the force normally has fire support limited to 120-mm mortars, MRLs, ATGM attack aircraft, and possibly a reinforcing artillery battery (towed 122-mm).

d. Pursuit. If the enemy observes any indication of retrograde operations, or attempts to disengage, he maintains pressure and takes up pursuit without further orders. The object of pursuit operations is to encircle and destroy opposing forces. Regimental or larger units conduct pursuit operations. You can organize specially tailored pursuit force units to prevent consolidation along defensive lines, block movement of reserves, seize water sources and any chokepoints along routes, and force retrograding units to halt and deploy.

The enemy moves on axes parallel to the retrograding force, staying as close as possible to maintain continuous observation, and allow simultaneous attack from march column to destroy the retrograding force.

Motorized rifle units maintain pressure against opposing forces while tank units, in march column, move on parallel routes. Air transported troops and advance units, such as a motorized rifle division's independent tank battalion operate up to 60 kilometers ahead of the main body. Units on these missions, however, have only limited endurance and the tank battalion in particular usually avoids becoming involved in sustained combat until it reaches its designated objective. Fresh units pass through others to maintain momentum.

2. How the Enemy Defends.

The enemy uses defense as a temporary measure. When necessary, he holds terrain with motorized rifle troops well dug-in, supported by ATGMs and tanks. Reserve tank units block and counterattack penetrations. Supporting field artillery often employ roving guns and batteries.

a. Hasty Defense. The enemy conducts a hasty defense when consolidating on a line, protecting the flanks of an advancing division, or when unable to continue to advance. Hasty defense is an expedient employed only until the attack can continue with deployment of second echelon forces.

Troops dig in quickly to establish company-size strongpoints, as shown in Figure 3-8. They bring forward all anti-armor equipment, such as "suitcase" Saggers and RPG-7s. BMPs remain near their platoons. Tanks are withdrawn to positions where they can be hull down, or where they can form a counterattack force. The regimental air defense battery deploys immediately, usually with SA-9s in the area of the regimental TOC and trains, and ZSU-23-4s roving. They give priority to field artillery fire plans, including direct-fire antitank fires.

The disposition of companies depends on the importance of the battalion sector and local obstacles. It is normal to find two companies forward with one company in reserve. This greater depth than usual occurs when natural obstacles, such as salt marshes, protect the flanks of a battalion position. When necessary, all three companies may be forward, with a small reserve of perhaps one motorized rifle platoon and a tank platoon. ATGM's cover large intervals between companies and battalions. They will plan antitank fire as far out as possible on either battalion flank.

b. Deliberate Defense. The enemy conducts a deliberate defense when it is clear that the attack cannot continue for several hours, or when higher headquarters halts offensive operations. When time permits, the enemy organizes his defense into a security zone and a main defense belt. If unable to do this, he simply defends from a main defense belt.

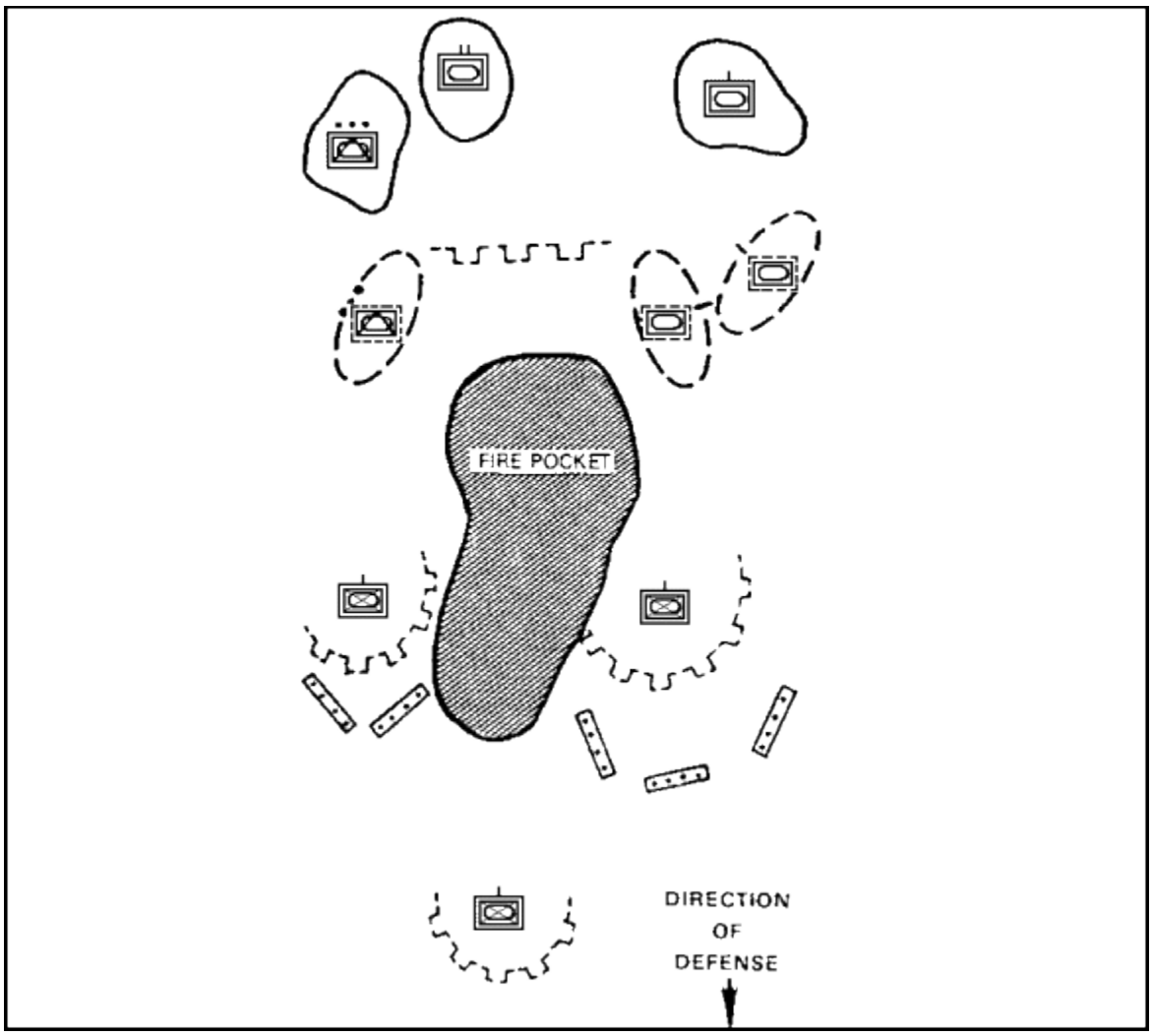

Figure 3-8. Threat Reinforced Motorized Rifle Battalion In Hasty Defense.

As shown in Figure 3-9, a security zone extends forward of the main defense belt as much as 20-30 kilometers or more. Normally, security zone outposts employ units from the division second echelon regiment, along with reconnaissance and combat forces from army. This forces an attacker to halt, or delays him by forcing him to deploy before reaching the main defense belt.

The enemy organizes the main defense belt to stop and destroy attacking forces. A division usually defends a zone about 20-30 kilometers wide and 20-30 kilometers deep, or sometimes deeper. They organize the defense in two echelons with two regiments in the first echelon and one in the second echelon. The first echelon regiments defend the forward eight to ten kilometers of the division's zone.

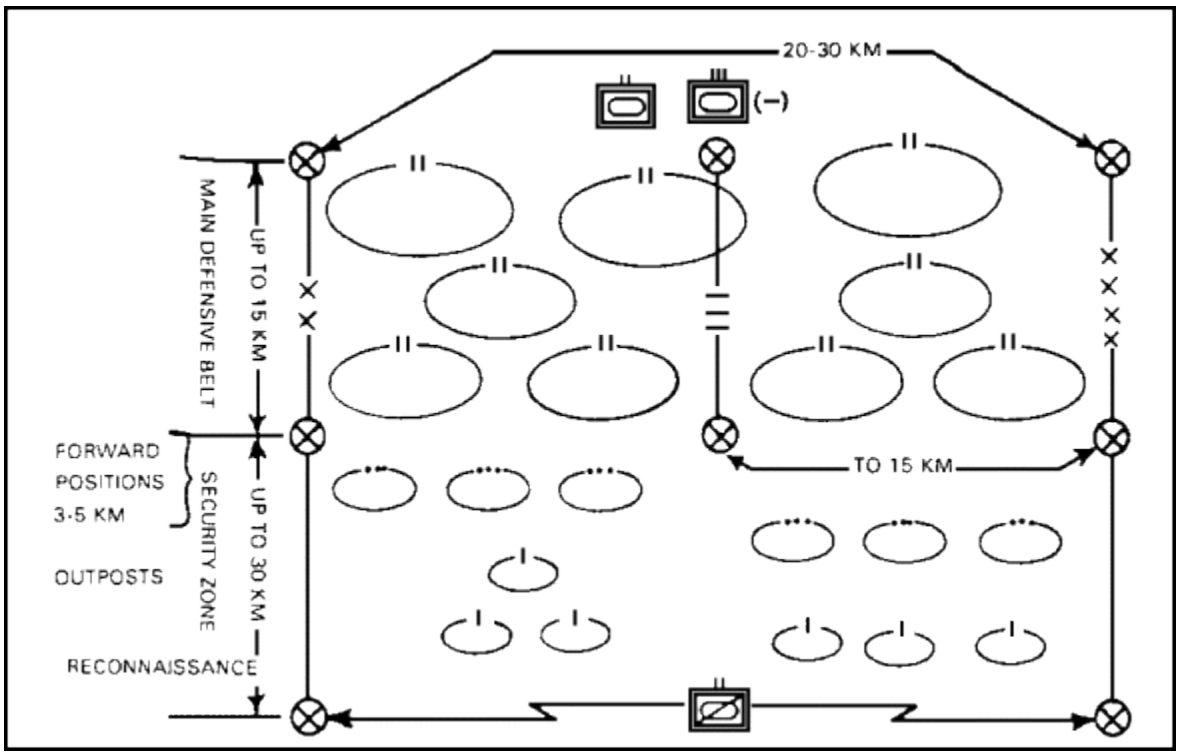

Figure 3-9. Threat Division Deliberate Defense.

Emplaced three to five kilometers forward of the main defensive positions are a series of forward positions consisting of platoons from the battalions which are in position in the rear of the regiment's area of operations. They employ these forward positions in a manner similar to the outpost line and withdraw to positions in the main defensive belt.

The second echelon regiment organizes three battalion defense areas across the rear of the division's zone. Reinforced battalions occupy these areas. They may keep about a platoon per company and possibly a company per battalion, in reserve. Combined arms reserves include some tanks for counterattacks and an antitank reserve to block any penetration. This reserve may consist of the tank regiment minus any battalions that are reinforcing the motorized rifle regiments and the divisional separate tank battalion. Within a motorized rifle division, for example, the reserves may consist of the entire tank regiment and the divisional 100-mm antitank gun battalion.

A battalion front varies from 5,000 to 7,500 meters. If the battalion has to cover a wide front, they use company strongpoints, or platoon strongpoints within company areas. Emplaced are two and sometimes three platoons in forward positions 2,000 meters in front of first echelon companies on the most dangerous avenues of approach. Their mission is to deceive the attacker and cause him to deploy. If encirclement is likely, forward positions normally withdraw.

Gaps between companies, battalions, regiments, and divisions may appear. Patrols and ambush parties keep gaps under observation during the day. Observation posts keep them under observation at night. Alternate direct-fire weapons positions can cover gaps, which are also covered by direct fire.

Army provides extra field artillery to a division, giving a minimum of four 18-gun battalions of either 122-mm howitzer, D-30 or 152-mm gun howitzers, D-1, or the 122-mm SP or 152-mm SP artillery

pieces. Provided to each regiment is at least one field artillery battalion, positioned well forward. As in the hasty defense, field artillery also has a direct-fire antitank mission. Reinforcing air defense artillery establishes an envelope stretching 20 kilometers forward of the line of contact.

Regimental mine-laying teams, supported by division minelayers, emplace minefields to protect company strongpoints and canalize enemy armor into fire pockets. They can lay approximately 500 meters of minefield per hour, with a density of 500-1,000 mines per kilometer. Antitank weapons cover the minefields. You can rig them for arming or detonating by remote control. The enemy also uses dummy positions.

Engage the attacker approaching the main position with

- indirect artillery at extended ranges.
- Sagger's and antitank guns at 3,000 meters.
- tanks and direct-fire artillery at 2,000 meters and less.
- SPG-9s at 1,000 meters.
- BMP main guns at 800 meters.
- RPG-7s and other infantry weapons at 600 meters or less.

The enemy emphasizes defense at night and during limited visibility such as sandstorms. Motorized rifle companies move to alternate positions after EENT as a deception measure. Tanks and infantry carriers, protected by infantry squads, move forward and to the flanks to ambush, and to cover intervals between units. Observation posts detect the attacker's active light sources. They freely use white light once an attack has started.

c. Strongpoints. You may encounter strongpoints not only as part of a deliberate defense, but also as protection for vital installations or key terrain features such as passes, important communication centers, etc. U.S. forces operating in deserts likely will encounter various types of strongpoint, depending on locale. Figure 3-10 shows examples of platoon-size strongpoints you will likely find in deserts of the Middle East.

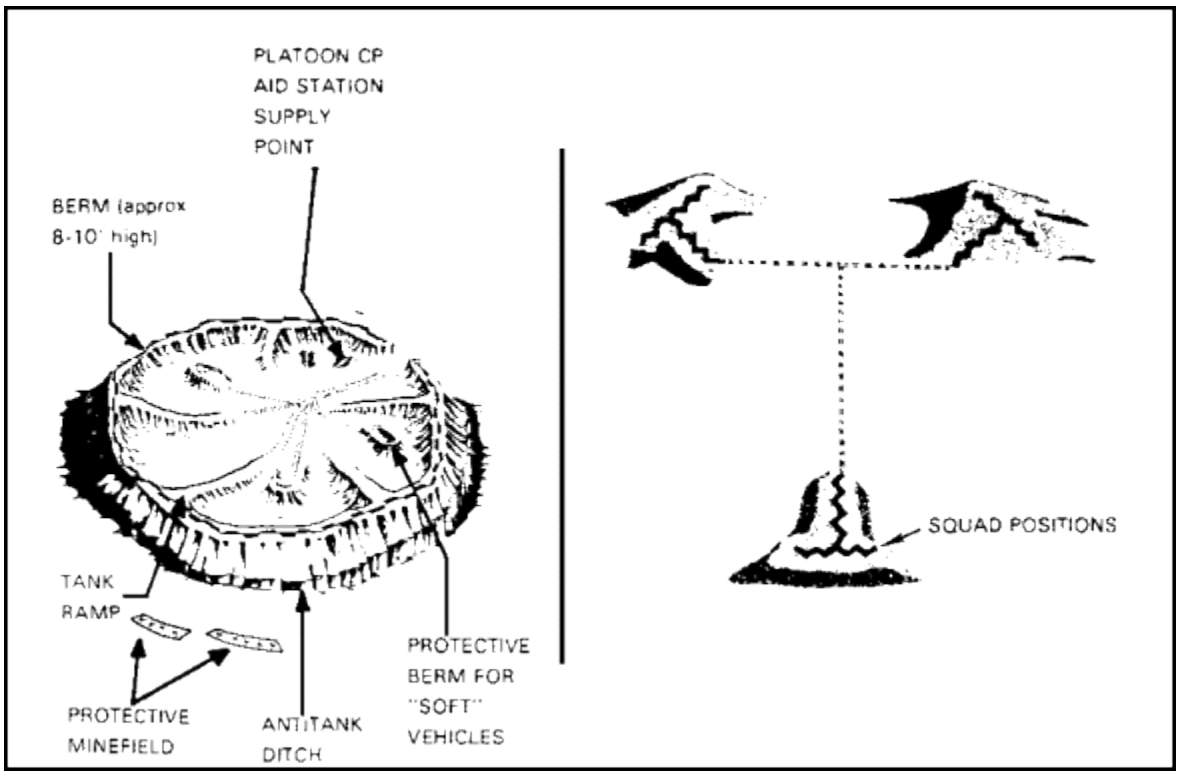

Figure 3-10. Threat Platoon Strongpoint Configurations.

Normally expect a strongpoint to contain antitank weapons and be well protected by minefields and antitank ditches. The combination of minefield, antitank ditch, and high berm results in a nearly tank-proof position. Furthermore, if they have dug in the trenches well enough, it may be able to withstand high concentrations of artillery fire. If you cannot bypass such strongpoints or if you absolutely must capture the position, you may have to take it by a dismounted infantry assault.

PART C - TIPS ON FIGHTING IN THE DESERT.

1. Intelligence.

Learn the following intelligence tips:

- Distances require longer lead times for reconnaissance and surveillance planning. Effective reconnaissance takes time.
- To confirm the intelligence template, the reconnaissance must identify (6-digit accuracy) approximately 80 percent of the enemy antitank systems.
- Scouts are reconnaissance patrols, not combat patrols, and should attempt to gain information through stealth.
- Consideration should be given to conducting reconnaissance during periods of limited visibility.
- You will encounter very few civilians in desert operations. Treat any information they give with caution.

2. Maneuver.

Learn the following maneuver tips:

- When moving in the desert, only terrain masking can provide cover because of the lack of heavy vegetation or manmade objects.
- You can easily see strong shadows from the air, because there is little vegetation in the desert.
- Disrupt shadows by altering the shape of equipment, using the correct angle to the sun to minimize shadow size and to cause shadows to fall on broken ground or vegetation whenever possible.
- Dig in equipment and use overhead cover or camouflage nets to reduce shadows.
- You must move vehicles and equipment as the sun moves.
- Shade optics to prevent shine.
- Open terrain and predominantly clear atmosphere generally offer excellent long-range visibility. However, at certain times of the day, heat may limit or distort visibility.
- The ideal observation position should have the sun behind it and be as high as possible to lessen the effects of mirages and heat radiation from the ground.
- Stake out your target line/engagement area (trigger point). This will prevent soldiers from engaging targets beyond the maximum effective range of the weapon system.
- Observation of fires may be difficult. The lack of visible terrain features distorts your ability to make range estimations.
- When preparing defensive positions, use every available means to know how far you can observe in front of your positions.
- The enemy can see as far as you can. Inspect your position from an enemy point of view.
- Light and noise at night may be seen or heard from miles away, so strict light and noise discipline are necessary.
- Muffle essential noise such as that produced by generator motors and keep the noise to a minimum by digging in or sandbagging the generator.
- Sand and dust reveal movement in the desert. It is best to move at night. This includes resupply as well as tactical movements.
- Sand obscures landing zones, distorts depth perception, and can disorient pilots.
- There are fewer terrain features in the desert. This hinders navigation and exposes friendly forces to the enemy.
- Take advantage of the least considered features to conceal movement, such as wadis. Always camouflage positions.

3. Fire Support.

Learn the following fire support tips:

- Artillery ammunition storage and handling is very important in a dry, hot environment. Very hot ammunition will affect the ballistic solution, which will cause the round to impact long or short of its intended target.
- Dig in storage positions for ammunition. This will keep it cooler.
- Use illumination or smoke rounds to reorient maneuver forces.
- The fire support coordinator is responsible for planning and coordinating all fires in the maneuver area of operations, that is, mortars, Air Force, Marine Corps, and Navy CAS, naval gunfire, and attack helicopters.

4. Mobility/Countermobility/Survivability.

Learn the following mobility/countermobility/survivability tips:

- Units should use linear obstacles to stop enemy movement due to lack of natural obstacles and excellent trafficability of the entire region.
- For efficiency, you must rapidly lay minefields over large areas.
- The enemy will try to attack with the sun low and behind him in an attempt to dazzle the defender.
- Engineer units must plan to have two operators for each piece of equipment because of extra maintenance requirements and harsh working conditions.
- Survivability positions are normally more important than antitank ditches, especially in open terrain.
- A tank platoon properly dug into two step positions can destroy a battalion. As such, earthmoving assets should focus initially on survivability positions.
- Since infantry can dig themselves in, normally the infantry works on digging in before assisting the engineers in the emplacement of mines. The engineer soldiers normally focus entirely on obstacles.
- Once the task force completes crew served positions with overhead cover, it reinforces the engineer soldiers emplacing obstacles to the maximum extent possible.
- Employ "basic loads" of Class IV (sand bags, pickets, etc.) with all vehicles to expedite digging in. The S4 must push forward replacement basic loads during the transition to the defense in standard infantry platoon packages.
- In the desert environment, all forces need camouflage and dispersion.
- Employ reverse slopes as much as possible and camouflage frontal parapets for individual/crew positions. This avoids the obvious bunker positions easily seen and destroyed by direct fire.

- Strong winds increase the evaporation rate of liquid agents and cause chemical clouds to act similarly to radio active fallout, over shorter distances.
- Extended depth and dispersion of vehicles will enhance your chance of survival.
- MOPP discipline and soldier reaction to chemical agents will enhance survivability.
- Engineers should carefully reconnoiter routes of march to avoid needless destruction of roadways, bridges, and pipelines.
- Armored vehicles survive longer when dug in. If we fight outnumbered and win in the desert, we must stress survivability positions.
- Use of dummy positions can conceal operational plans to deceive the enemy as to real location of potential targets such a fighting positions or trains areas.
- High temperatures of the desert day increase the incapacitating effects of liquid agents, which rely on skin penetration, in a comparatively small area around the target.
- Air instability is most likely to cause quick, vertical, and irregular dissipation of an agent, leaving the target area relatively free of contamination quickly.
- Chemical weapons used during the heat of the day are normally persistent nerve or blister agent.
- Strong winds can increase the evaporation of liquid agents and cause chemical clouds to act similarly to radioactive fallout.

5. Air Defense.

Learn the following air defense tips:

- Airspace management difficulties are compounded in the multinational environment. Therefore, you must formalize SOPs to formalize airspace policy.
- Within the BCE, you cannot bring about adequate coordination with host nation forces without host nation liaisons to the BCE.
- Camouflage and dispersion are of the utmost importance to air defense systems. Direct sunlight can also have an effect on the Stinger system.

6. Combat Service Support.

Learn the following combat service support tips:

- Medical support of defense in the desert environment associates with great distances. The depth and dispersion of the defense create significant time/distance problems.
- In a nonlinear desert defense, enemy and friendly units will intermingle, especially in poor visibility.
- Medical treatment and evacuation will become more critical in the desert. The effectiveness of the combat lifesaver program has been proven.

- Medics must constantly recertify and train designated combat lifesavers. The standard should be at least one per squad.
- Rehearse how your unit will identify, treat, and evacuate casualties. This is as important as how you will fight.
- Constantly clean all weapons. When not in use, keep weapons covered. Covered weapons may still have sand on them, so clean the weapon frequently so it will be ready when needed.
- PMCS in the desert is absolutely essential. Left unattended, sand and wind rapidly destroy the most basic piece of a soldier's gear.
- Sand clogs fuel lines, wears out tires and other rubber and plastic parts fast. It also seeps into engines and cooling systems. This results in overheated engines which can cause sudden and catastrophic failure.
- Food service organizations require intense supervision. Augment current menus with fresh fruit, vegetables, and breads to provide soldiers the nutrients they need.

7. Command and Control.

Learn the following command and control tips:

- Commanders should attempt to operate where they can maintain contact with forward units in critical spots and with the TOC.
- Desert evenings can be extremely long or short. Leaders should be concerned with EENT, BMNT, and percentage of illumination. These factors will be extremely important when fighting night battles.
- Dry desert conditions can, at times, reduce radio signal strength and create unforeseen blind spots, even in aircraft operating nap of the earth.
- FM communications may degrade due to dead spots caused by heavy concentrations of minerals close to the surface. Establish firm procedures for constant control, either by radio or through liaison.
- Ensure that all know the commander's intent and rehearse battle drill, so actions are understood even without good communications.

LESSON 3
PRACTICE EXERCISE

Instructions The following items will test your knowledge of the material covered in this lesson. There is only one correct answer for each item. When you have completed the exercise, check your answers with the answer key that follows. If you answer any item incorrectly, study again that part of the lesson that contains the portion involved.

Situation: You are a member of a fighting force engaged in combat operations in the desert. Therefore, it is vital that you know tactics for desert operations.

1. You are called to a meeting to discuss tactics for a pending campaign in a desert environment. The objective of your unit operations is to

   ○ A. dominate terrain from which you can pin down and destroy the enemy.
   B. seize and retain as many terrain features as possible.
   C. maximize tank and armored cavalry mobility, flexibility and firepower in hot, barren mountains.
   D. maneuver at measured tactical speeds only during periods of clear visibility.

2. After maneuvering to your objective, you need to establish observation posts. You tell your OPs

   A. to inspect the positions from the enemy's point of view to maximize cover and concealment.
   B. to disregard dust clouds which are mirages at more than five kilometers away.
   C. there should be no problem observing direct fires in the desert.
   D. to place initial rounds short of the target to blind the enemy.

3. After briefing your OP's, you set up additional reconnaissance and security measures. Your major means of reconnaissance is

   A. dismounted infantry.
   B. ground scouts.
   C. air cavalry.
   D. observation posts.

4. Your navigation mainly depends on available maps. You also take into consideration that

   A. radar devices are limited to night time use.

   B. sun compasses are less reliable on moving vehicles than lensatic compasses.
   C. gyro compasses can be used as gun azimuth stabilizers for maintaining direction.
   D. RF beacons and homers must be co-located with friendly forces on high ground.

5. To prevent casualties from friendly fire and identify friendly forces, you
   A. ensure IFF procedures for ground troops are more thorough than aircraft IFF.
   B. use colored pennants in different daily positions, but not attached to antennas.
   C. never broadcast radio transmissions in areas previously held by the enemy until you have moved headquarters.
   D. use liaison officers or messengers for units on the move.

6. You improve tactical advantage with deception operations. One deception method you should use in desert warfare is to

   A. move around and vary the locations of dummy supply stocks and wheel tracks daily to simulate a POL installation.
   B. emplace live mines to improve credibility of a phony minefield.

   C.construct field artillery decoys only when simulators are available.

   D. vacate your dummy positions as soon as possible.

7. The single most important mission of engineers in desert operations is

   A. preposition field artillery pieces for long-term indirect fire.

   B. locate air Defense Artillery as far away as possible from its supported unit to confuse enemy ECM.
   C. water supply.

   D. direct traffic in the wide-open desert.

8. Combat Service Support can have complications in the desert. A factor you need to be aware of is

   A. the minimum demand for water is ten gallons per day per man.

   B. since air transportation is unlimited, keep your wheeled supply vehicles as far to the rear as possible.
   C. combat boots may last only two weeks in harsh rocky terrain.

   D. you can expect relatively easy medical evacuation by air.

9. You must plan methods of defense against the enemy in desert terrain. A very possible factor is
   A. the enemy prefers frontal attacks with swarms of infantry.
   B. when a motorized rifle division attacks in two echelons, a tank regiment brings up the rear in second echelon fire support.
   C. the enemy frequently uses smoke screens to confuse the defender.
   D. the enemy plans meeting engagements as harassment against forces he cannot directly defeat.

10. During pursuit of the enemy in desert operations, you can expect
   A. the enemy to use nuclear or chemical strikes only after conventional fires have failed.
   B. a second echelon of airborne enemy troops to join enemy forces.
   C. the enemy not to attack retrograde operations.
   D. enemy forces to have a tank battalion operating 60 kilometers ahead of the main body avoiding combat until reaching a designated objective.

11. You must anticipate what kind of defense a desert-warfare enemy is likely to throw up. You can expect
   A. a hasty defense of company-size strong points along flanks of an advance.
   B. a deliberate defense along a continuing attack and kill zone with a second-echelon security zone.
   C. forward positions that will fight to the last man.
   D. the enemy to maintain white-light discipline throughout the defense.

12. A "lesson-learned" tip on fighting in the desert is
   A. scouts must blast their way through strongpoints.
   B. you must move vehicles and equipment as the sun moves.
   C. grouping together for "strength in numbers" will enhance your chance of survival.
   D. along your route of march, destroy as many roadways, bridges and pipelines as possible.

LESSON FOUR

ATTACKS AND DEFENSE

OVERVIEW

TASK DESCRIPTION:

In this lesson, you will learn to identify and select the fundamentals, considerations, and methods of attacks used in offensive operations in a desert environment. You also will learn to identify and select the fundamentals and environmental considerations used in defensive operations in a desert environment.

LEARNING OBJECTIVE:

TASKS:	Identify and select the fundamentals, considerations, and methods of attacks used in offensive operations in a desert environment. Identify and select fundamentals and environmental considerations used in defensive operations in a desert environment.
CONDITIONS:	You will be given information from FM 90-3.
STANDARDS:	Identify and select the fundamentals, considerations, and methods of attacks used in offensive operations in a desert environment, and identify and select the fundamentals and environmental considerations used in defensive operations in a desert environment in accordance with FM 90-3.
REFERENCES:	The material contained in this lesson was derived from the following publication: FM 90-3, Desert Operations

INTRODUCTION

The following material discusses offense and defense as modified by desert terrain. As in all other environments, the purpose of the attack in desert terrain is to destroy the enemy. You accomplish this by (1) concentrating friendly forces at a weak point in the enemy defense and destroying enemy combat units or by (2) driving deep into the enemy rear to destroy his combat service support and cut his lines of communication. No force can survive for long in the desert without combat service support.

Terrain constraints in seeking and destroying the enemy do not restrict an imaginative commander. Due to the scarcity of key terrain in desert, normally the only constraints placed upon a maneuvering force will be the forces ability to

- maintain responsive combat service support.
- protect its combat service support from enemy attack.

The longer the lines of communication become, the more susceptible they are to being cut. In most deserts, the scarcity of large areas of defensible terrain means that an enemy force has at least one flank open to attack. The attacking force must seek this flank and attempt to maneuver around it into the enemy rear before the enemy can react and block the envelopment with mobile reserves.

PART A - ATTACKS USED IN OFFENSIVE OPERATIONS IN A DESERT ENVIRONMENT

Successful offensive operations depend on rapid, responsive, and violent maneuver, seeking a vulnerable enemy flank and exposing none to the enemy. The enemy, realizing the danger of remaining stationary in this terrain, may choose to defend by attacking. The resulting engagement between two attacking forces will often be a series of flanking actions and reactions. Success goes to the one who can find the other's unguarded flank first.

Units of an attacking force may conduct or participate in any one of the following types of offensive operations:

- Movement to Contact.
- Hasty or Deliberate Attack.
- Exploitation or Pursuit.

Within a division, lead elements of forward units may conduct a deliberate attack on an enemy weak point or flank to open a gap for following units to move through and exploit success. Lead units of the exploiting force will conduct a movement to contact and hasty attacks to overcome pockets of enemy resistance.

1. Fundamentals of Offense.

a. Purpose of the Offensive. The task force conducts offensive operations to achieve one or more of the following specific purposes:

- Defeat enemy forces.
- Secure key or decisive terrain.
- Deprive the enemy of resources.
- Gain information.
- Deceive and divert the enemy.
- Hold the enemy in position.
- Disrupt an enemy attack.

b. Characteristics of Offensive Operations. Battalion task force operations are characterized by surprise, concentration, speed, flexibility, and audacity.

(1) Surprise. Surprise is achieved when the enemy cannot react effectively to the task force commander's scheme of maneuver. Surprise may be achieved by—

- Conducting thorough reconnaissance and surveillance.
- Striking the enemy from an unexpected direction at an unexpected time.
- Employing deception efforts.

(2) Concentration. Concentration is the massing and synchronization of overwhelming combat power against an enemy weakness. Concentration is achieved by—

- Planning on the basis of information generated by aggressive reconnaissance.
- Fixing the enemy to prevent his reaction to maneuver.
- Rapidly massing forces and fires to overwhelm the enemy defense.
- Synchronizing maneuver with combat support.

(3) Speed. The task force moves quickly to take advantage of enemy weaknesses. Speed in execution is key to denying the enemy time to reposition or reorient to meet an attack. Speed is achieved by—

- Planning and rehearsing battle drills.
- Conducting route reconnaissance.
- Wargaming contingencies with subordinate leaders.
- Exercising responsive command and control.
- Issuing mission-type orders.
- Using routes, movement techniques, and formations that allow the force to move rapidly and with security.
- Isolating enemy forces through fixing and suppressing fires.
- Providing rapid resupply with logistics packages (LOGPACs) to sustain the task force's offensive capability.
- Maintaining momentum to keep the enemy from reestablishing his defense.

(4) Flexibility. Flexibility is the ability to divert from the plan and exploit success by maintaining freedom of maneuver. Flexibility in planning results from wargaming. Flexibility is achieved by—

- Aggressive reconnaissance that continues to seek enemy weaknesses and ways to attack him from his flanks and rear.
- A reserve that can assume the mission of the main attack or exploit an enemy weakness. A reserve is the commander's primary means of maintaining flexibility.
- A command and control system that allows the commander to rapidly transmit decisions during the battle.
- The use of FRAGOs, checkpoints, and reserve graphic control measures.
- Contingency planning that permits shifting the main effort

(5) Audacity. Audacity is the willingness to risk bold action to win. The audacious commander is quick and decisive, and willing to take prudent risks. He bases his decisions on sound tactical judgement, personal observation of the terrain, and first-hand knowledge of the battle. He constantly seeks to attack the enemy on the flanks or rear and to rapidly exploit success. He shares the hazards of the battlefield with his troops, moving to the critical places to lead by example.

(1) The task force participates in the following five major types of offensive operations:

- Movement to contact.
- Hasty attack.
- Deliberate attack.
- Exploitation.
- Pursuit.

(2) The task force normally participates in these operations as part of a larger force. Commanders at each level

- Find or create a weak point.
- Suppress enemy fires.
- Isolate the enemy and maneuver against weak points.
- Exploit success.

2. Environmental Considerations.

a. Navigation. Lack of clearly defined terrain features complicates navigation and phased operations. Units conducting an enveloping maneuver are liable to lose direction unless they have reconnoitered routes carefully by the maximum number of leaders. Leaders may employ unit navigators. Although, they will be unable to control direction at night unless permitted to use radio. Mark routes with insignificant objects (such as small rock piles), and employ GSR sections to confirm locations.

b. Sandstorms. Do not allow attacking forces to get caught in unexpected sandstorms. Movement through a sandstorm will depend on the unit's distance from the enemy, trafficability, presence of minefields, and direction and density of the storm.

If a storm blowing from the enemy catches the advancing unit, the safest alternative is to halt until the storm abates. In this situation, the enemy will regain observation before the attacker. Begin suppressive fires on enemy positions as the storm lifts. In other situations it may be possible for platoons to form close column, using tail lights only, and continue movement. When the storm is blowing towards the enemy, it is possible and extremely effective, to conduct an attack immediately behind the storm.

c. Fires. Plan your fires as in temperate climates on any available terrain features. However, plan your targets using coordinates, when there are no significant terrain features along a route

of advance. A moving force in a desert is at a disadvantage in comparison with a stationary unit due to lack of concealment and the presence of dust clouds. The defender may engage with missiles from an unexpected direction or from terrain features of no apparent significance. The attacker must be prepared to shift fires rapidly to suppress unforeseen targets. The command may use tactical aircraft to suppress or destroy targets. You can mark targets for aircraft with indirect- or direct-fire smoke. White phosphorus or illuminating rounds set for low air burst also are effective.

d. Maneuver. If terrain permits masking of maneuvering units and trafficability is good, use normal fundamentals of fire and maneuver. Restricted trafficability may arise from rocky terrain as in the Golan Heights, or the ground may be so flat that the defender has total observation of the area. Movement in these circumstances requires speed of maneuver, deception, and considerable suppression to degrade enemy observation and fires. You should avoid frontal attacks, especially in conditions of restricted trafficability. It is preferable to maintain pressure on enemy units in unfavorable terrain, while other forces find enemy weakness in terrain more favorable for an attack.

e. Tactical Deception. Deception plays a key part in offensive operations. Divide deception into two parts (objectives): First, weaken the local defense by drawing reserves to another part of the battlefield. This may be done by making a small force seem larger than it is. Second, conceal the avenue of approach and timing of the main attack. You can use some of the following attack methods:

- Dummy units and installations.
- Phony radio traffic.
- Movement and suppressive fires in other areas timed to coincide with the real attack.
- Smoke. You can place a screen across a possible avenue of approach. The defender's attention is drawn to it while the force attacks from a totally different angle.

f. Combat Service Support. Offensive operations in this environment may involve considerable expenditure of ammunition and high POL consumption. Units must carry maximum available combat supplies and plans for resupply must be widely disseminated and clearly understood.

NOTE: Use every opportunity for resupply.

Report the location of captured enemy supplies to higher headquarters immediately.

3. Attack Operations.

Most offensive operations in desert warfare result in meeting engagements and hasty attacks. In order to get into the enemy's rear, it is sometimes necessary to mount a deliberate attack to penetrate a strong defensive system established around natural or artificial obstacles. The following examples describe one way in which a meeting engagement might occur, and one way you might conduct a deliberate attack. These scenarios are examples of how you might fight particular battles. Every commander must apply the principles according to his experience and best judgment in each new situation.

4. Meeting Engagement.

a. Characteristics. A meeting engagement occurs when a moving force, incompletely deployed for battle, meets a stationary or moving enemy force, about which it has inadequate intelligence. The action ceases to be a meeting engagement when the situation develops and subsequent operations are undertaken. Meeting engagements may occur at all echelons in both offensive and defensive situations. However, they occur most frequently when moving to contact. The principal characteristics of meeting engagements are a limited knowledge of the enemy and limited time for the commander to develop the situation and to formulate and execute plans.

NOTE: The key to a meeting engagement is to seize and retain the initiative. By retaining the initiative, a commander can later adopt the best course of action to accomplish his mission.

b. Actions. The following actions can assist division, brigade, and battalion commanders in retaining the initiative.

- Make a rapid estimate of the situation and issue fragmentary orders.
- Commit units from march column.
- Organize an advance guard with mobile forces capable of delivering large volumes of direct fire, capable of rapid deployment, and capable of speed in the attack. Use armored cavalry, air cavalry, or tank-heavy teams.
- Intersperse field artillery throughout the formation with some well forward so that indirect fires will be immediately available during any contact.

The enemy develops the situation vigorously and aggressively. Flanking movements generally disclose the enemy's configuration more rapidly than frontal movements and give more opportunity for tactical surprise and decisive results.

c. Example. The following example illustrates those points.

The 52d Infantry Division (Mech) receives orders to move east to contact enemy forces believed to be present and occupy a movement objective that includes a series of small oases and water holes about 80 kilometers away. On the division right, 3rd Brigade organizes with two tank battalions, one mechanized infantry battalion, one field artillery battalion (155-mm, SP), one engineer company, and one Vulcan battery. The commander organizes three tank-heavy battalion task forces and deploys for the movement as shown in Figure 4-1.

The brigade requires each leading battalion task force to provide a tank-heavy team as advance guard. They move by traveling overwatch or bounding overwatch as the situation dictates. Right task force is screening the brigade flank with its scout platoon. It can commit one, two or three teams if a threat develops on the right. Left task force maintains contact (not shown) with 2nd Brigade. The brigade commander moves well forward, mounted in a brigade helicopter. Each leading task force commander also has a brigade helicopter. Additional observation helicopters from division artillery supplement the advance guard company teams. Rear task force is responsible for rear guard and has a tank-heavy team

marching at the rear with the battalion scout platoon (not shown). Dispersed throughout the brigade are field artillery batteries, Vulcan platoons, and engineer platoons.

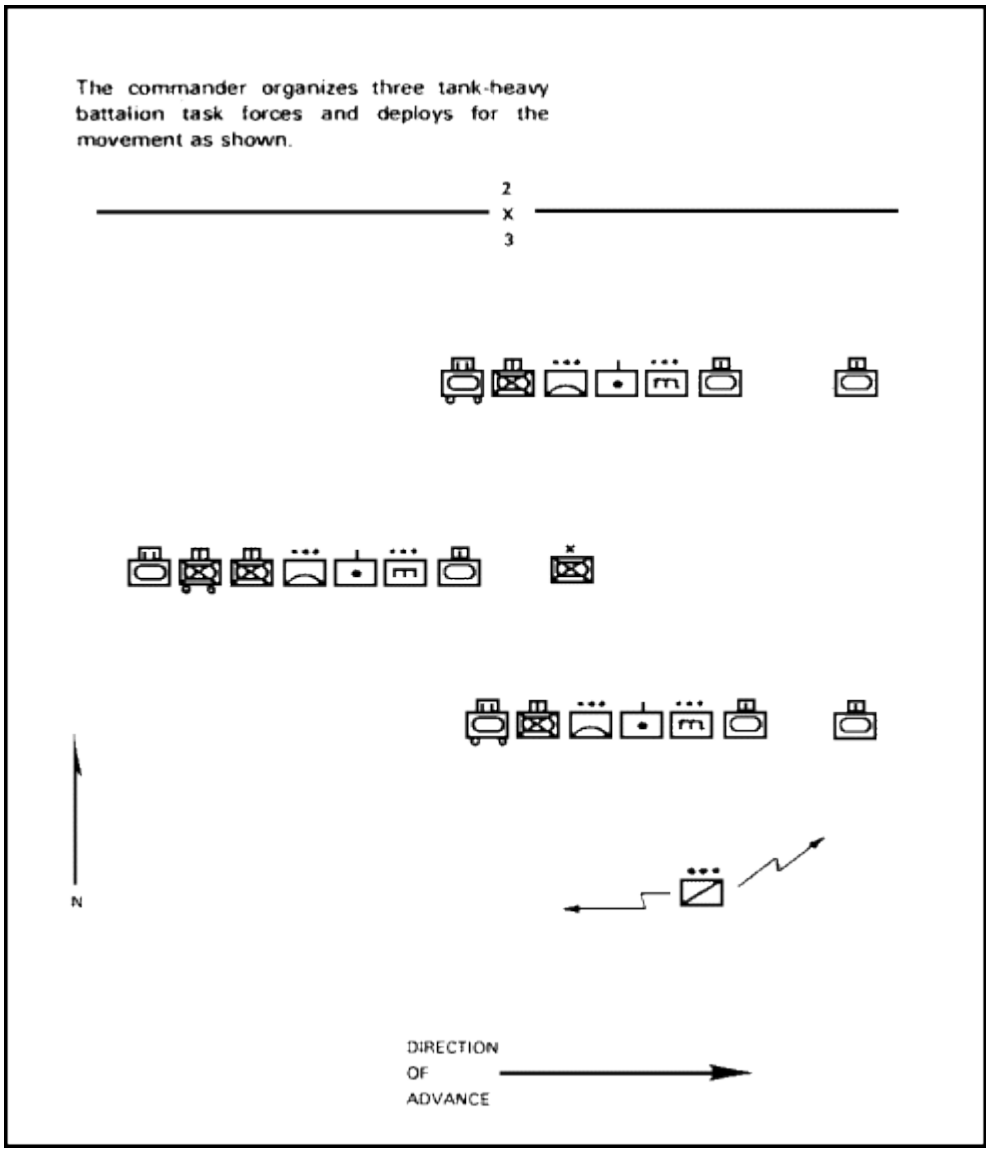

Figure 4-1. Tank-Heavy Task Forces Deployed for Movement.

To complete the operation by nightfall and so U.S. forces will have the sun at their backs, commence the operation in the afternoon. Note the meeting engagement aspect of Figure 4-2.

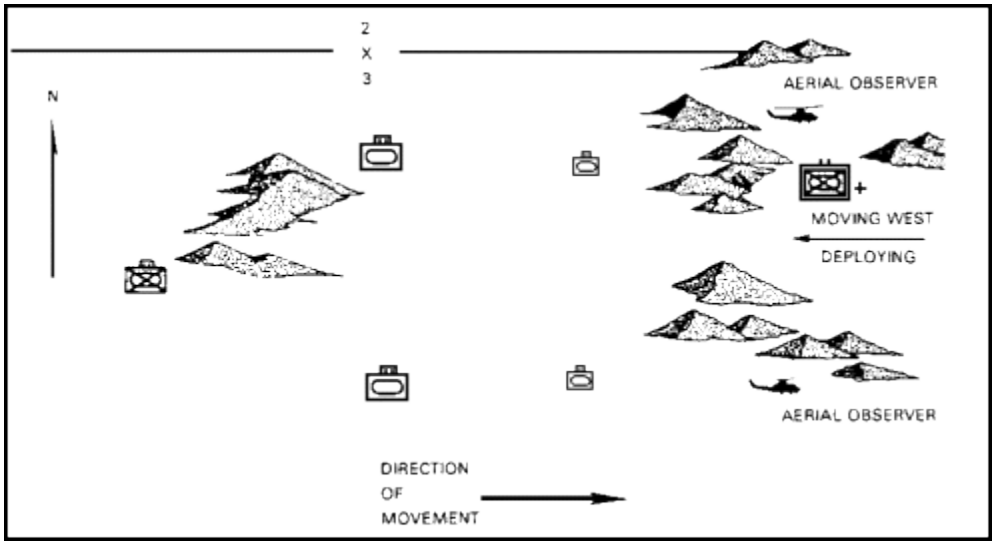

Figure 4-2. Meeting Engagement.

At first, movement is rapid and no sign of enemy activity. After about 40 kilometers, aerial observers report several small dust clouds to the front and move off to investigate. The leading tank-heavy teams provide overwatch but continue to move. Shortly thereafter, the helicopter on the left receives a high volume of fire from automatic weapons. The observer reports an estimated 25 BMPs and six or seven tanks moving west on a collision course with 3rd Brigade. You speculate this enemy force is a reinforced motorized rifle battalion, deploying from battalion column to company columns at the time of the report.

The aerial observer completes his initial fire request as ground fire forces the aircraft away. An aerial observer for the south reports no enemy activity except the now increasing volume of dust he can see to the north. The brigade commander, satisfied that fire is being placed on the enemy and that reports are on the way to division, tells his S3 to be certain 2nd Brigade is aware of this contact. He then turns his attention to further developing the situation and ordering whatever deployment is necessary.

It becomes apparent, as the leading forces rapidly close with each other, that the enemy is starting to veer slightly to the north, toward 2nd Brigade. Behind the leading enemy force another cloud of dust reveals a larger force also moving rapidly west. The brigade commander orders task force left to block and destroy the leading enemy force. He redirects the remainder of the brigade to the southeast to attack the enemy main body from the south and trap it against 2nd Brigade. He orders redeployment as shown in Figure 4-3.

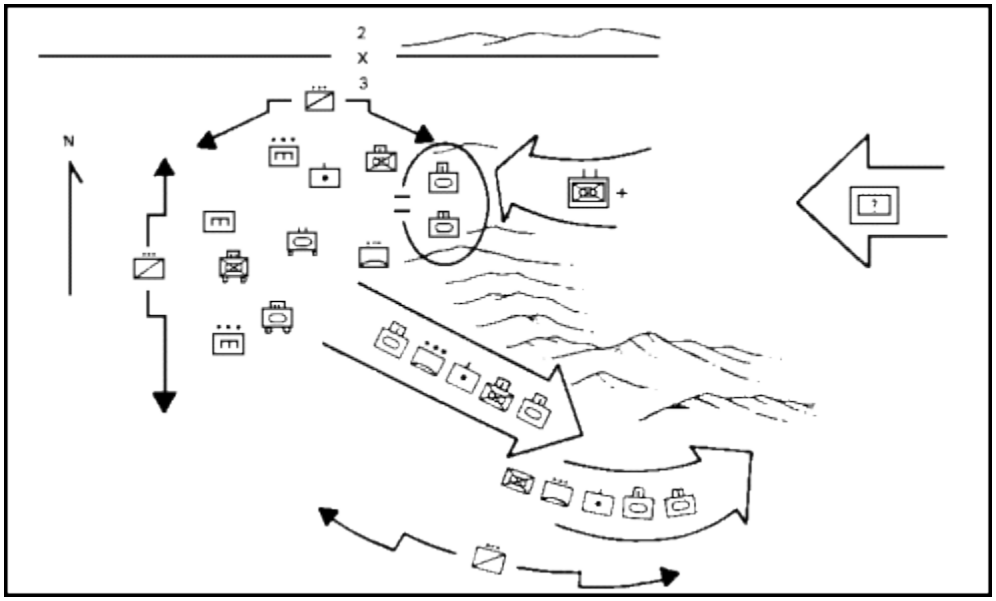

Figure 4-3. Flanking Movement.

Task force left moves to block the enemy advance and provide a pivot around which the brigade will maneuver. Its rear team moves to the north to prevent enemy maneuver into the 3rd Brigade left flank. Its scout platoon screens the left flank and maintains contact with 2nd Brigade. The field artillery battery is in position and firing on the enemy battalion. The trains of all three task forces have dispersed within a lightly manned perimeter. On the west the scout platoon of task force rear is screening. The three engineer platoons not needed in support of this maneuver, provide backup for the scout screen. Task forces right and rear, with field artillery batteries and ADA platoons are maneuvering to strike the enemy main body from the south. The brigade commander intends to make a wide envelopment and thus must take the field artillery batteries with him. The scout platoon of task force right screens the right flank as before.

Having developed the situation, planned the attack, and started to maneuver, the brigade has completed those actions that are part of a meeting engagement. Actions that follow are, in this case, a hasty attack, as shown in Figure 4-4.

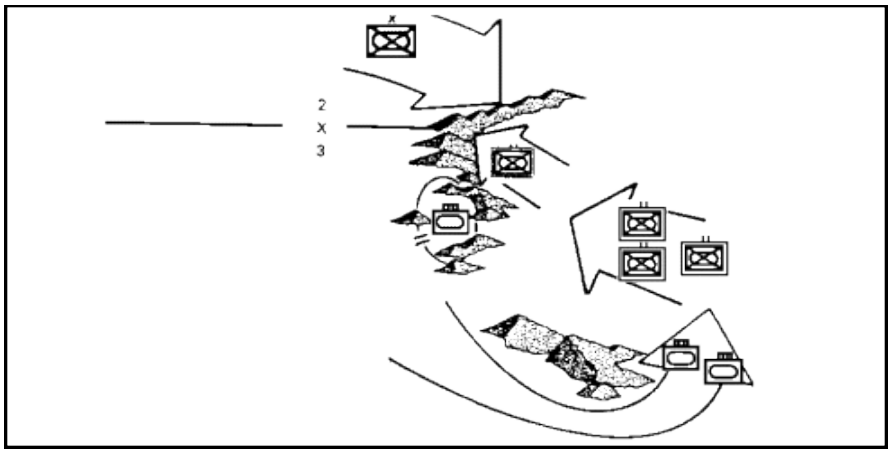

Figure 4-4. Hasty Attack.

The 3rd Brigade commander chose this plan for several reasons. Halting to defend would not satisfy the mission of securing the oasis area still 30-40 kilometers away. Maneuver to the north would drive the enemy to the south and perhaps into the rear or behind 52d Infantry division (Mech). Maneuver to the south drives the enemy to the north and into the path of 2nd Brigade where destruction of the enemy is quick.

5. Deliberate Attack.

The following example describes one way in which an attacking division and a brigade might take advantage of the speed and mobility afforded by desert terrain. You must remember that as the terrain in the desert becomes more broken, the techniques employed in the attack will more closely resemble those employed in more temperate environments where natural obstacles abound.

a. General Situation. The 25th Armored Division is making the main attack as part of the corps. The corps has been advancing against scattered resistance for the last 24 hours. Corps G2 has indicated that forward units of the corps will strike the first echelon of the enemy main body the following day. The best intelligence estimate is that the enemy will continue to defend in place.

b. Special Situation 1. Air and ground reconnaissance has revealed that enemy units occupying defensive positions in the 25th Armored Division zone appear to be three motorized rifle regiments of a motorized rifle division. A situation map like the one shown in Figure 4-5 can be drawn. Reconnaissance has not yet located the tank regiment of the division, but it presumably occupies positions in the division second echelon, prepared to counterattack.

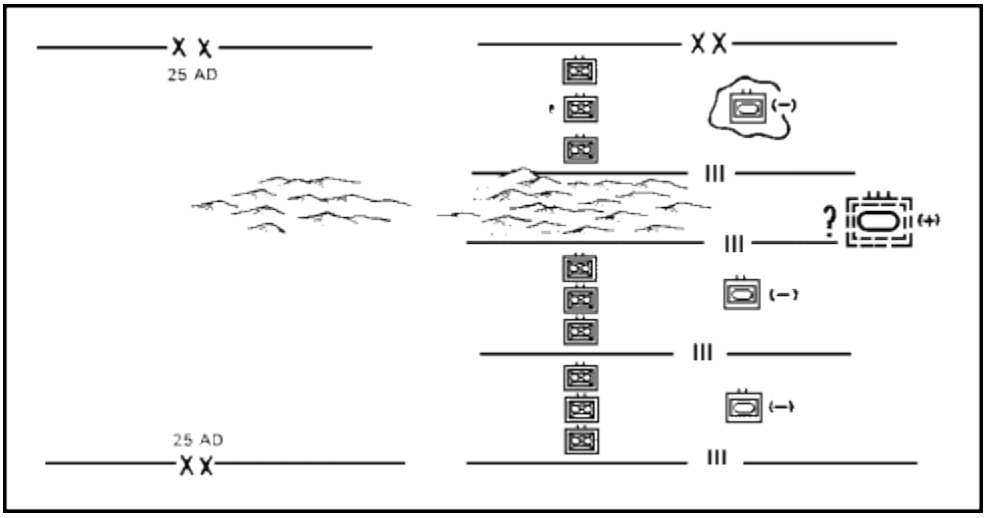

Figure 4-5. Motorized Rifle Division in the Defense.

The G2 estimates that the regiments are defending with all three motorized rifle battalions forward. A few tanks have reinforced each motorized rifle battalions. However, the bulk of each motorized rifle regiment's tank battalion appears positioned in depth in the regimental second echelon. An area of very rocky broken ground, judged impassable to track vehicles, separates two of the regiments. This obstacle is unoccupied, heavily mined and covered by observation and indirect fire. Two kilometers to the front of the enemy's positions is another area of impassable ground, approximately three kilometers in diameter. This ground also will present an obstacle that you must bypass.

The 25th Armored Division has the mission of penetrating the enemy division first and second echelons. The corps reserve will attack through the penetration to drive into the enemy rear to cut lines of communication and destroy the enemy combat service support system.

As drawn in Figure 4-6, make the division main attack on a narrow front by a balanced brigade of two tank and two mechanized infantry battalions, south of the obstacle in late afternoon. The brigade will attack to secure an objective approximately ten kilometers deep, and will then continue the attack to the east on order. The second brigade, also balanced, will conduct a supporting attack to the south of the main attack to secure an objective in the enemy first echelon.

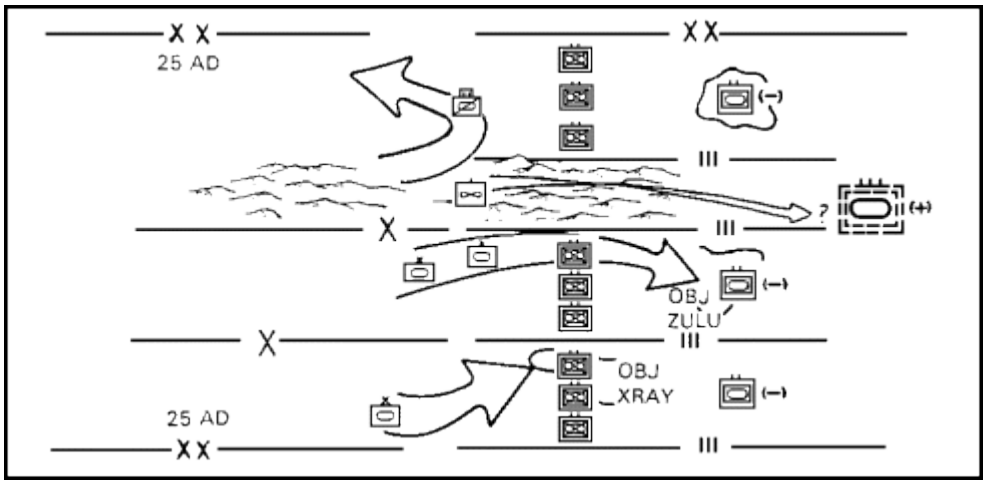

Figure 4-6. Division Attack.

The division reserve is a three-battalion tank-heavy brigade. It will follow the main attack, prepared to assist or assume the mission of the leading brigade, and prepared to destroy counterattacks by enemy regimental tank battalions or the enemy divisional tank regiment. The division cavalry squadron will conduct a demonstration to the north of the obstacle as part of the division deception plan. Use all available indirect fire to seal off the objective areas. A corps attack helicopter company is under operational control of the division to assist in the destruction of enemy counterattacks.

This course of action has the following advantages:

- Orienting the main attack on an objective immediately south of the obstacle prevents counterattack and direct-fire engagement by enemy units positioned to its north. It also affords the main attack a degree of flank protection. The concentration of a brigade on an estimated enemy company creates a force ratio favorable to success.
- A supporting attack and a demonstration will deceive the enemy as to the exact location of the main attack, force him to delay commitment of reserves, and prevent local counterattacks against the main attack by forces in the first echelon.

It is impossible to conceal the movement of the main attack. A rapid advance however, will provide the enemy a moving target and obscure all but the leading vehicles-with a large dust cloud. Suppressive fires on and around the objective will degrade enemy direct fire from the front and flanks. Attacking from the west will force enemy gunners to look into the afternoon desert sun to engage targets. Finally,

the enemy second echelon will carry out operations after nightfall, compounding confusion and control problems of enemy counterattacks.

Locate the reserve to further concentrate combat power against the enemy's weakest point. After the 1st Brigade penetrates the enemy's first echelon, the reserve can either pass through to attack the second echelon or react in any direction to destroy enemy counterattacks.

Continuing the attack east into the enemy rear with the main attack or the reserve brigade will retain the initiative, maintain the momentum of the attack, and orient on the enemy's greatest vulnerability-his combat service support system.

c. Special Situation 2. The brigade conducting the main attack organizes with two mechanized infantry battalions and two tank battalions.

(1) Plans. It has one field artillery battalion in direct support and reinforcing fires from two additional battalions. Two engineer companies are also in direct support. Based on his analysis of terrain, the brigade commander realizes that his units will be unable to conceal their approach from the enemy. He therefore plans to approach the enemy positions as rapidly as possible from an area far enough away that the rolling terrain and heat haze will initially obscure visual observation. The dust cloud created by the brigade will inform the enemy that a large force is approaching, but it will also prevent the enemy from determining the size and composition of the force. During the approach, suppress enemy positions with smoke. Battalion task force scout platoons will move ahead of the main body to identify obstacles.

(2) Situation. Figure 4-7 shows a situation map.

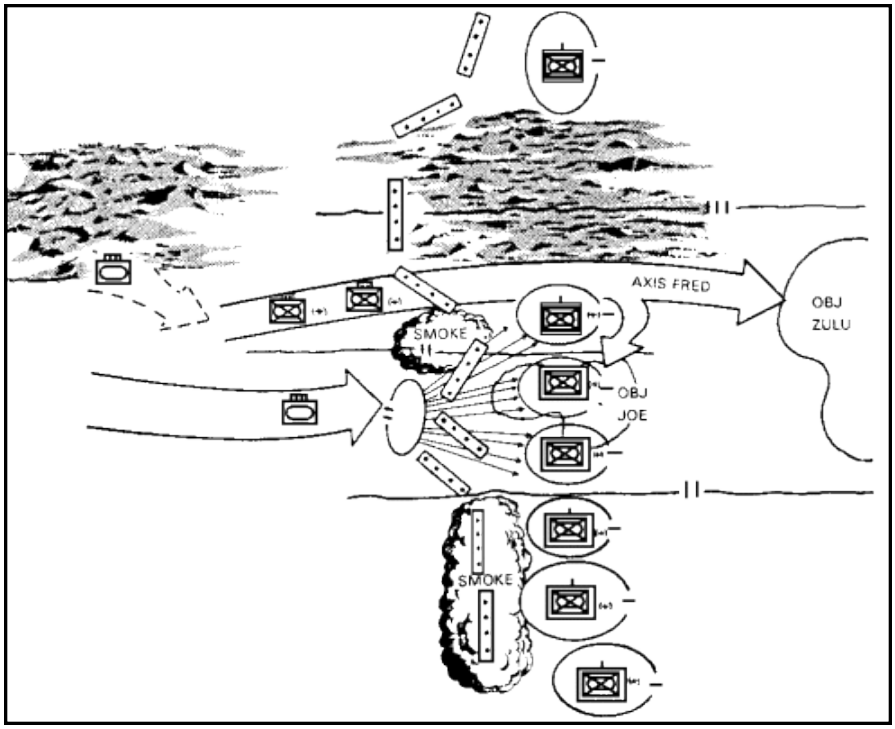

Figure 4-7. Division Main Attack.

Leading the main attack will be a heavily-mechanized battalion task force with the mission of punching through the enemy first echelon just south of the obstacle. The following task force, also mech-heavy will follow in and attack the enemy first echelon unit on objective JOE from the rear. A tank-heavy task force-initially the brigade reserve will follow these two mech task forces. An engineer company will accompany each attacking mech-heavy task force. Meanwhile, a tank battalion task force will advance on the right (south) and abreast of the leading mech task force. It will take up firing positions and suppress enemy first echelon positions immediately to the south of the area of penetration. When the second mech task force assaults objective JOE from the rear, this tank battalion will follow the tank-heavy task force of the brigade along axis FRED and become part of the brigade reserve. These two tank-heavy task forces will rapidly press forward on axis FRED and seize objective ZULU.

(3) Threat. The major threat to the success of the plan is a counterattack by the regimental tank battalion or the divisional tank regiment. The division supporting attack and demonstration, may tie these enemy forces down. However, the brigade commander makes plans to defeat a counterattack from any direction if the enemy determines the location of the main attack and commits his tank units before the brigade has reached its objective.

(4) Attack. Initially, the obstacle will protect the northern flank of the brigade. The brigade main attack will be exposed to an enemy counterattack from the south, but unless the counterattack takes place before the brigade supporting attack has reached its objective or the main attack has punched through, the fires of both battalion task forces will destroy it. With his entire regimental sector under attack, it is unlikely that the enemy regimental commander will be able to determine the time and place to commit his tank battalion until it is too late. Once the brigade reserve is through the first echelon, an extremely unfavorable force ratio will face a counterattacking enemy tank battalion.

(5) Counterattack. The enemy tank regiment also poses a dangerous threat. A counterattack by a force that size early in the attack will have a good chance of blocking the penetration. Fortunately, facing the enemy division commander is a problem similar to his regimental commander's. With the entire division under attack, it will be extremely difficult for him to determine the correct time and place for the counterattack. The attack helicopter company committed through the gap in the enemy defenses can intercept the enemy tank regiment, attack it by fire, and delay any counterattack against the penetration. Once the brigade secures its objective, circumstances will force the tank regiment to attack a defending force of equal size with the advantages accruing to the defender. Once the division reserve brigade moves up behind the leading brigade, a counterattacking enemy regiment will expose itself to counterattack.

(6) Attack Plan Advantages. The brigade plan of attack has the following advantages:

- Plan the main and supporting attacks on narrow fronts to increase the attackers chances of attaining favorable force ratios. The main attack takes advantage of an enemy weakness by attacking through an area occupied by minimum enemy forces and with one flank protected by an obstacle.

- The proximity of the main and supporting attacks allow mutual support.
- The reserves, readily available for commitment, will support the main effort with their fires.
- A rapid, violent advance out of the sun will make target acquisition and engagement difficult for enemy gunners who are not suppressed.
- The plan takes full advantage of the mobility and speed of track vehicles.
- The scheme of maneuver keys on terrain mobility and speed and allows enemy commanders very little information or time to react.
- The plan fully supports the division scheme of maneuver to rapidly advance into the enemy's rear to destroy his combat service support.

d. Special Situation 3. Organized as before, the reserve brigade has two tank battalions and one mechanized infantry battalion. The division mission is to penetrate the two defensive echelons of the enemy division. Thus, this organized brigade has sufficient tank strength to assist the 1st Brigade (main attack), assume its mission, or defeat enemy counterattacks. When you commit this brigade, it will become the main attack of the division. It will have a battalion of field artillery in direct support, and as much additional field artillery support as you can devote to this action at the time. The brigade has a combat engineer company and an air defense artillery battery. These make a strong and self-contained combined-arms force capable of semi-independent action, needed to achieve decisive results in this attack.

Launched on schedule, the attack by 25th Armored Division progressed generally according to plan. The enemy commander, apparently unable to determine where the main thrust was coming from, withheld his counterattacks. As shown in Figure 4-8, 1st Brigade (main attack) succeeded in penetrating the enemy first echelon and continued, with little loss in momentum, toward objective ZULU. As the leading battalion task forces approached ZULU they reported a counterattacking enemy tank force approaching from the southeast.

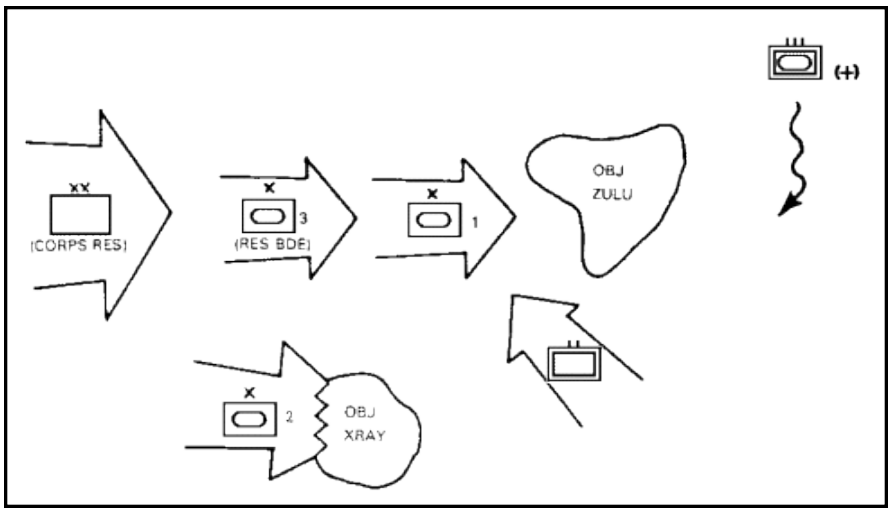

Figure 4-8. Enemy Counterattack.

1st Brigade committed its following battalion task forces to continue into objective ZULU while the leading task forces met this enemy counterattack. At approximately the same time the division G2 received information from the commander of the attack helicopter company that the enemy tank regiment was under attack and was moving south. When the corps commander evaluated the situation, including the progress of 25th Armored Division, the movement of the tank regiment, and original corps plan, he issued a fragmentary order.

He instructed 25th Armored Division to continue toward ZULU and to defeat the enemy tank regiment on ground that would leave the way clear for the corps reserve division to pass north of ZULU and into the enemy rear.

Based upon this, Commander, 25th Armored Division, identified three options. He could:

> (1) Commit his reserve brigade to the southeast to meet and block the enemy regiment somewhere south or southeast of ZULU. This had the advantage of keeping 25th Armored Division forces massed to some degree. It had the disadvantages of requiring maneuver of the reserve brigade through or around the ongoing battle between 1st Brigade forces and the smaller enemy counterattack, and of meeting the enemy regiment nose on.
>
> (2) Commit his reserve through objective ZULU to strike at the flank of the enemy regiment. This angle of attack would be advantageous, but the requirement to pass through 1st Brigade and ZULU would slow the commitment of the reserve.
>
> (3) Commit his reserve around the north side of objective ZULU to strike the enemy tank regiment in its flank and rear. This would be slower in terms of overall distance to travel, but require no passing of one force through another. It also would permit pinning the enemy against 1st and 2nd Brigades. Most importantly, it tended to ensure that the major enemy forces in the area would be out of the way of the corps reserve as it passed to the north of ZULU.

The 25th Armored Division commander chose option (3) and committed his reserve brigade at once. Once committed, the brigade received direct support of one field artillery battalion. Due to the distance over which this wide envelopment was to take place, this field artillery battalion accompanied the brigade until it reached an area from which it could provide fire for the attack. Air defense weapons and engineers also moved out with the brigade.

A situation shapes up like Figure 4-9. As 3rd Brigade attacked into the flank of the enemy regiment, the leading brigade of the corps reserve division drew abreast of objective ZULU and continued on to the east into the rear area of the enemy division.

As shown in Figure 4-10, the three U.S. brigades trapped and destroyed the enemy tank regiment. The 25th Armored Division then consolidated, reorganized, and prepared to continue to the east to follow and support the corps main attack. In this situation the 25th Armored Division succeeded in rupturing the defenses of an enemy division, cleared the way for the corps reserve to exploit the breakthrough, and met all counterattacks. It applied offensive fundamentals to desert environment and defeated an enemy division.

e. Special Situation 4. The following example describes one way in which a tank company team might conduct an advance guard mission during a movement to contact. In this situation the 25th Armored Division is moving rapidly through the enemy security zone in order to rapidly close on the main enemy defense positions. Company A is the advance guard for the task force and has three tank platoons and one attached mechanized infantry platoon. A squad of combat engineers is with the mechanized infantry platoon to assist in breaching minefields. The battalion's AVLB section is in direct support and available to the company commander on call. Dedicated to Company A is an artillery battery of 155-mm SP howitzers.

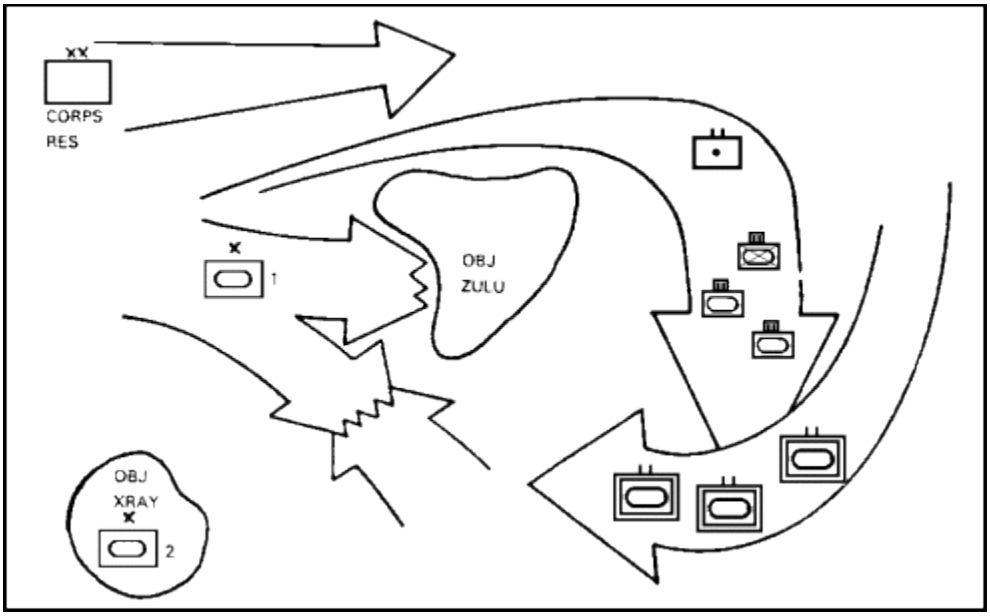

Figure 4-9. Reserve Attacks Flank of Counterattack Force.

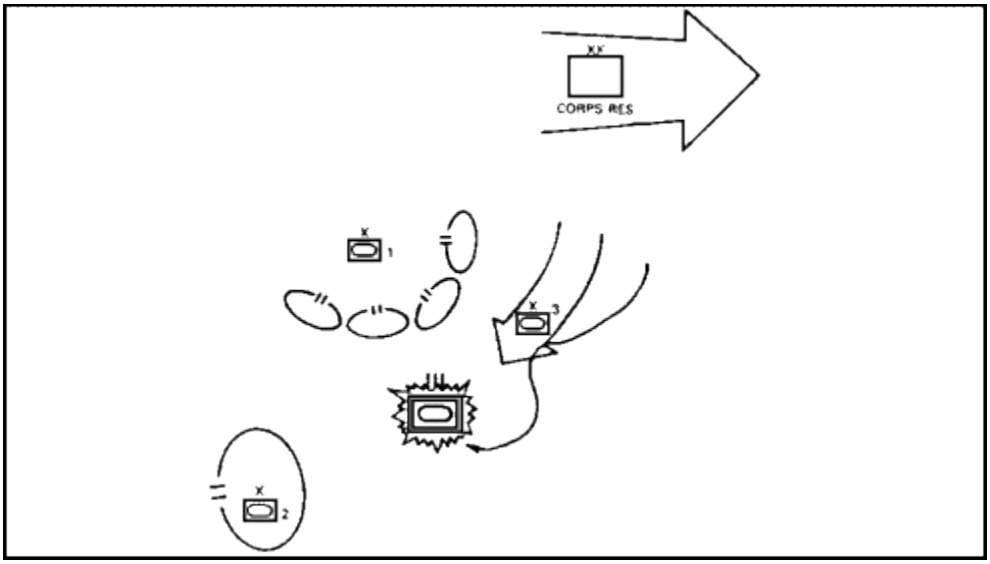

Figure 4-10. Counterattacking Force is Destroyed.

Figure 4-11 depicts the enemy and terrain. Many hills and ridge lines break up the desert terrain. They rise to an average height of 20-30 feet above the desert floor. Armored vehicles can scale most of these

terrain features. The enemy has a dug-in infantry platoon and tank platoon on Hill 391 surrounded by a protective minefield. Dug to the north of Hill 371 is an antitank ditch. It is anchored on the east by a steep escarpment that is untrafficable to armored vehicles. Hills 413 and 301 have enemy tank platoons located on them. Hill 419 has an enemy infantry platoon dug-in. It is supported by an antitank platoon of BRDM vehicles with Sagger missiles. A protective minefield partially protects it to the south and east. Located along the desert road between Hills 413 and 301 is an enemy artillery battery of six 100-mm howitzers.

As shown in Figure 4-12, Company A advances to the north by employing the bounding overwatch technique with its platoons. The lead tank platoon, the 1st Platoon, occupies Hill 399. The mech infantry platoon follows and also occupies Hill 399. They observe to the front and determine that the enemy does not appear to occupy Hills 397 and 385. They observe enemy positions on Hill 391, but since they are out of effective range no one exchanges fire. The company commander passes the 2nd Tank Platoon around Hill 399 and occupies Hill 397. Enemy tanks on Hill 391 open fire against the 2nd Platoon on Hill 397. The 2nd Platoon returns the enemy fire. Desiring to build up his firepower as rapidly as possible, the company commander moves the 1st Platoon from Hill 399 to Hill 397 to join the 2nd Platoon and bring its fires against the enemy on Hill 391. The mech platoon follows but remains in complete defilade behind Hill 397. The company commander decides to move his 3rd Tank Platoon to Hill 385 in order to get better flanking shots into the enemy tank platoon positions. The 1st and 2nd Platoons cover by fire the movement of the 3rd Platoon. With platoons in good firing positions on Hills 397 and 385 a tank duel ensues with the enemy on Hill 391. You place artillery fires on the dug-in enemy infantry platoon in order to suppress any suitcase Saggers that may be present on that position.

You employ smoke against the tank platoon on Hill 413 to ensure that it cannot bring effective fires against friendly elements. Due to superior tank gunnery, the overwhelming volume of fire, and the excellent angles of attack, the friendly tanks gain the edge in the duel and knock out several enemy tanks. The company commander senses the moment is right to take Hill 391.

Keeping the 3rd Platoon on Hill 385 to overwatch the movement of his other platoons, the company commander begins his maneuver. His forward observer calls upon the battalion 4.2-inch mortar platoon to lay down a small smoke screen northwest of Hill 397 to shield his movement forward to a small hill. This small hill north of Hill 397 is the last cover available before assaulting the enemy on Hill 391. From this closer range, the two tank platoons deliver more effective fire against the remaining tanks of the enemy tank platoon. Now you direct the combined suppressive fires of the dedicated artillery battery and the battalion 4.2-inch mortar platoon against Hill 391. You employ both smoke and HE rounds. As soon as this suppressive fire becomes effective the maneuvering tanks and APCs move rapidly to the minefield. Under cover of the tank and artillery fire, the combat engineers swiftly breach a lane through the minefield and tanks and mech infantry pour through as fast as possible. The mechanized infantry rapidly dismount their carriers and get into the enemy trenches to root out the last remaining enemy resistance. Company A rapidly consolidates and reorganizes on Hill 391.

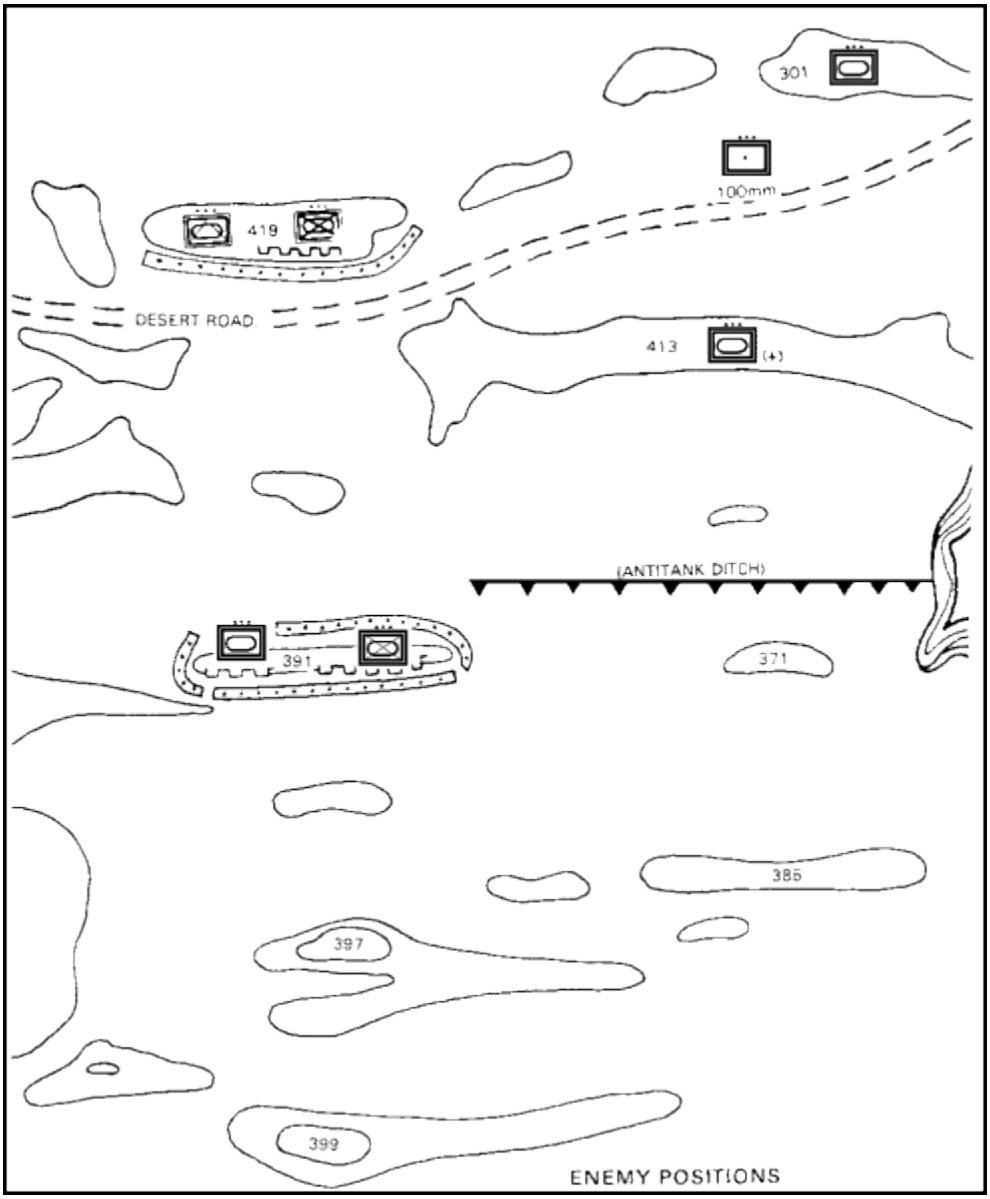

Figure 4-11. Special Situation 4.

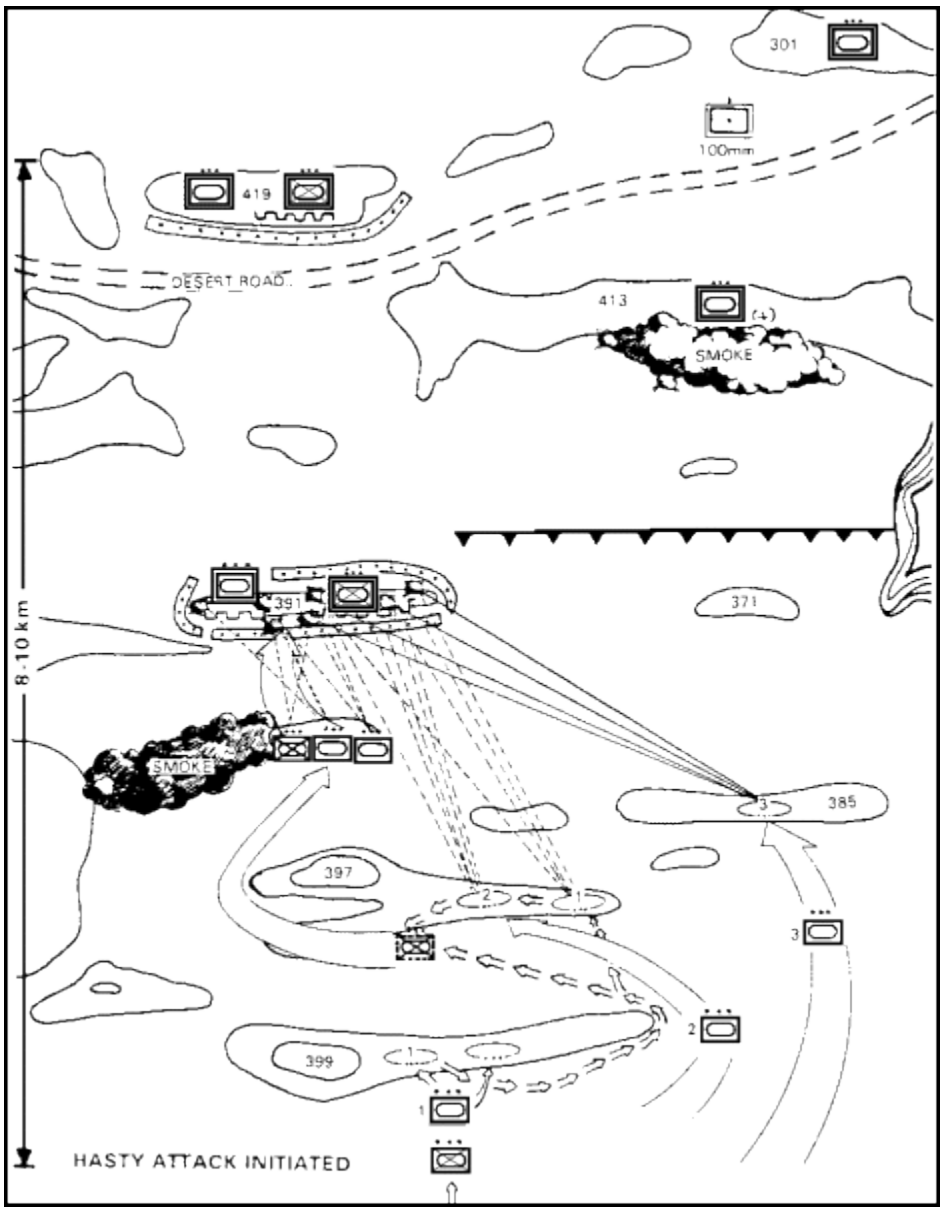

Figure 4-12. Hasty Attack Initiated.

The company commander acts decisively to keep up the momentum of the advance, as shown in Figure 4-13. The 1st and 2nd Platoons immediately engage the enemy tank platoon on Hill 413. The company commander shifts the smoke to Hill 419 in order to obscure the vision of the enemy Sagger gunners located on that position. Under the covering fire of the two tank platoons on Hill 391, the 3rd Platoon advances to the north to Hill 371. The engineers bring forward an AVLB and under the covering fires of all three tank platoons, it spans the antitank ditch. The 3rd Platoon rapidly crosses the antitank ditch on the AVLB and takes up firing positions on a little knoll just to the north of the ditch. Under the covering fires of the 3rd Platoon on the knoll and the 1st Platoon on Hill 391, the 2nd Platoon and the mech platoon move across the antitank ditch and join the 3rd Platoon. The combined fires of all three tank platoons take a heavy toll, knocking out three tanks of the enemy platoon. The surviving tank withdraws to the north. Observing this withdrawal, the company commander rapidly advances the 2nd and 3rd Tank Platoons.

This rapid advancement to Hill 413 catches the enemy artillery battery in the open as they were in the process of withdrawing from their position. The two tank platoons completely destroy the surprised enemy artillery battery. The mech platoon closes on Hill 413, but remains in complete defilade. From his positions on Hill 413 and Hill 391 the Company A commander now directs his fires against the enemy on Hill 419, as sketched in Figure 4-14. He smokes the enemy tank platoon on Hill 301 in order to reduce its effectiveness. Elements bring to bear artillery, mortar, and tank fires against Hill 419 in order to suppress the Sagger missiles on that position.

Under cover of this suppressive fire the two tank and one mech platoons on Hill 413 begin to maneuver to assault the enemy on Hill 419. The 3rd Tank Platoon moves to a good firing position on the western edge of Hill 413 in order to bring effective fires to bear at a short range. Under cover of the fires of the 1st and 3rd Platoons, the 2nd Platoon and the mech infantry platoon breach the minefield and assault the enemy positions. As soon as they are into the enemy positions on Hill 419 the 3rd Platoon moves up rapidly to join them in mopping up the last remaining enemy resistance.

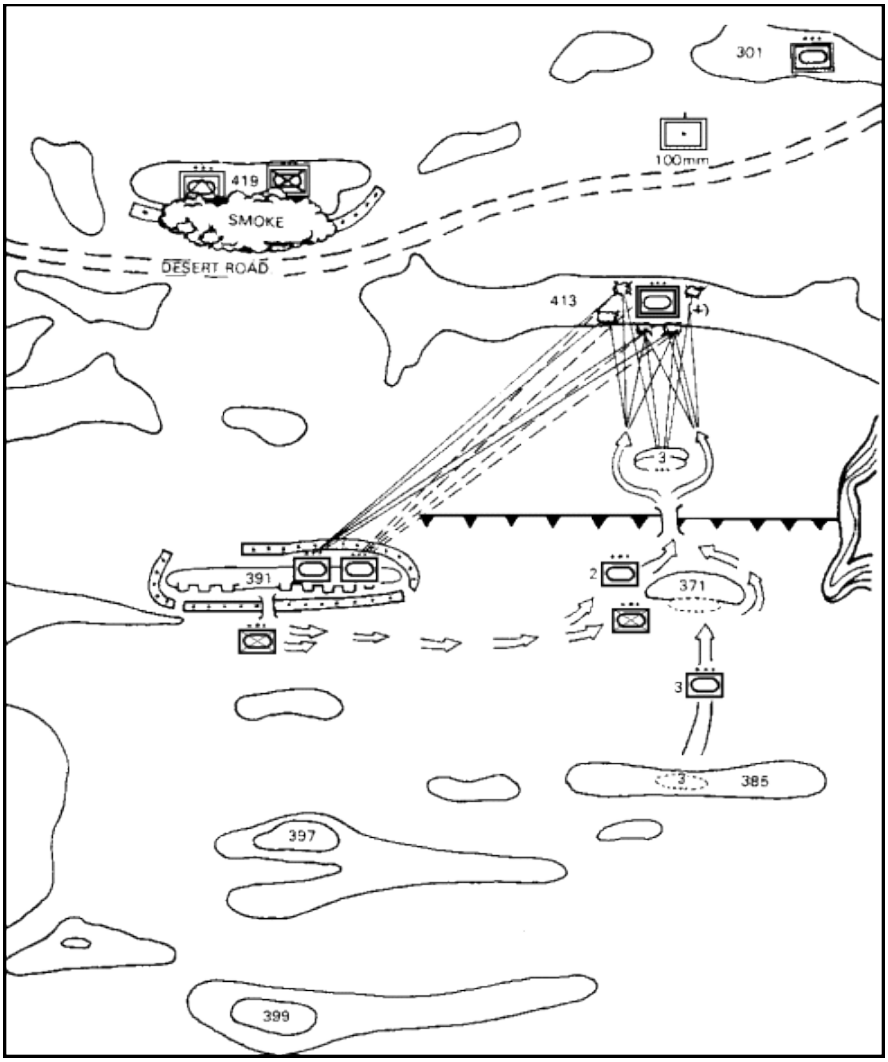

Figure 4-13. Continuing the Attack.

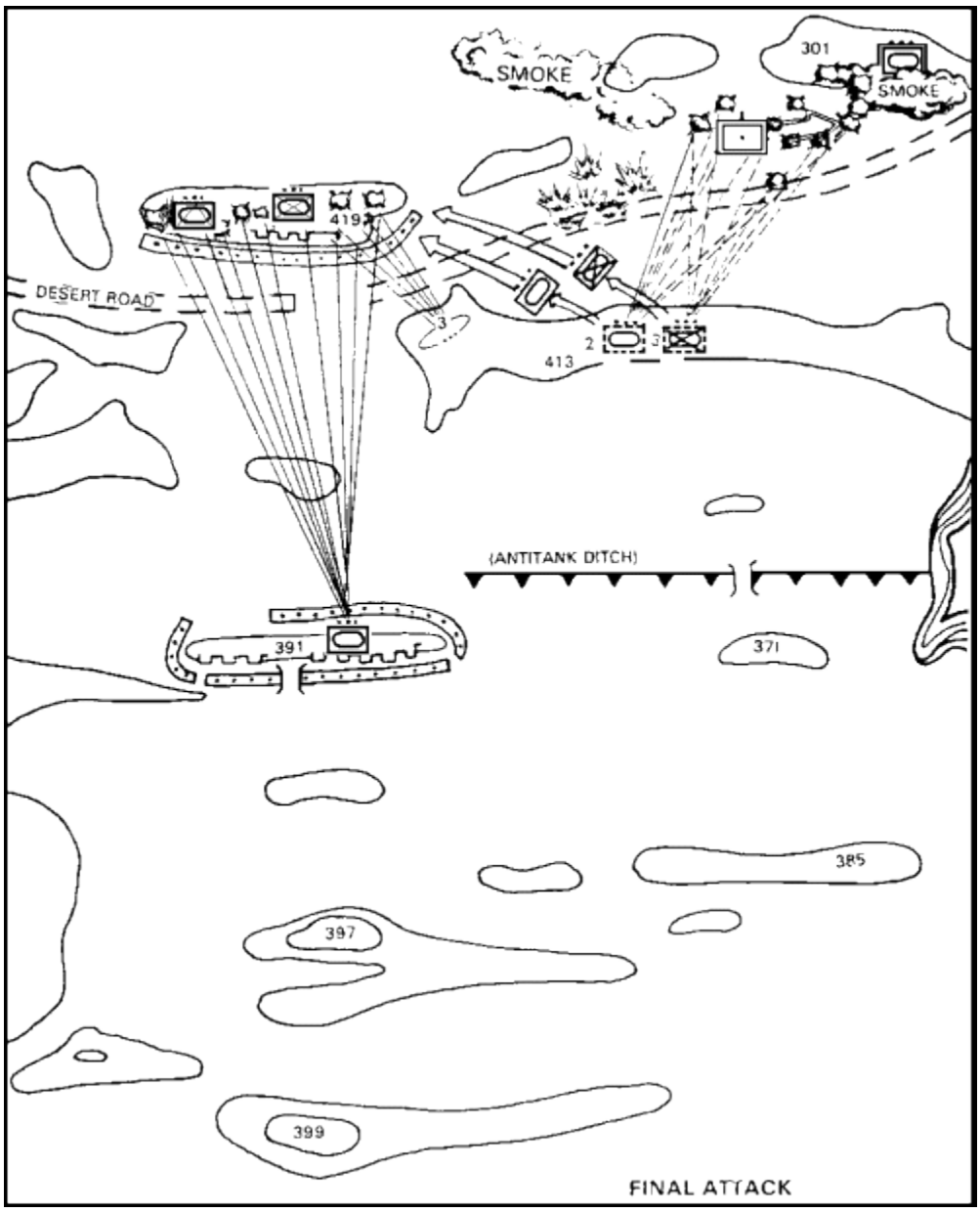

Figure 4-14. Final Attack.

This example highlights the following techniques:

- One element is always in position to cover by fire while another element is moving to a new position.
- Effectively employed, the combined arms team of tanks, infantry, and artillery, maximize the capabilities and minimize the limitations of each. No single arm can do it alone.
- Making the maximum use of terrain to protect friendly elements from enemy fire while moving and to provide good firing positions.
- The momentum of the attack maintains a rapid and aggressive tempo.

f. Special Situation 5. Because of the possibility of encountering strongpoints during desert operations, the following example suggests one way to attack a strongpoint. Normally, you should bypass strongpoints or neutralize them by air or artillery whenever possible. However, there may be times when there is no other recourse but to assault and capture a strongpoint. In such a circumstance you normally conduct the attack of a strongpoint by dismounted infantry at night or possibly during a blinding sandstorm to achieve surprise and minimize casualties. The following example presents one technique for reducing a specific type strongpoint. This attack is described in three phases. However, during the conduct of the operation these phases flow together rapidly.

(1) Phase I (Breaching). The first phase consists of breaching the minefield, shown in Figure 4-15. Preferably, combat engineers perform this task. However, all infantrymen must be trained and prepared to accomplish this. The construction of this type of strongpoint is such that it is usually not practical to assault it with armored vehicles. Therefore, you must use dismounted infantry.

The breaching group may consist of three separate elements-a breaching team and two suppression teams. The breaching teams may consist of an engineer squad to breach the minefield and an infantry squad to assist and to help the assaulting forces to get through the lane, the antitank ditch, and over the berm.

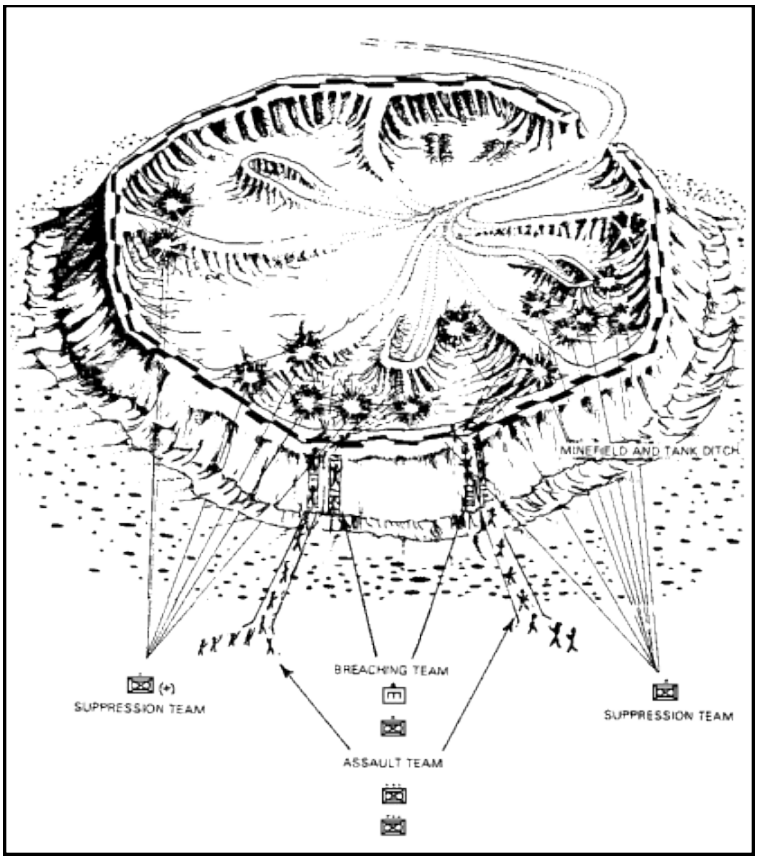

Figure 4-15. Attacking a Strongpoint— Phase I (Breaching).

Stealth characterizes the initial phase of the attack. No one opens fire until the enemy discovers the attack. Once the enemy discovers the attack, the suppression teams concentrate a high volume of automatic weapons and antitank fires near the intended breaching points. Other tanks and APCs are used farther to the rear in an over-watching role. They may intensify their fires once they discover the attack. Similarly, after discovering the attack, artillery and mortar fires (HE and smoke) suppress the entire strongpoint. Once breaching terms have breached the minefield, they assist the passage of the assaulting forces. They mark the lanes, set up small ladders, and help the assaulting troops to their objective.

One technique to do this is to use small colored lights to designate which troops go to the right and which go to the left. For example, a small blinking blue light would indicate members of one platoon go to the right while a small blinking red light would indicate forces of another platoon go to the left. This is important in the smoke and confusion of an assault.

(2) Phase II (Assault). Phase II begins as the assault groups abandon their attack positions and charge through the breached minefield and into the strongpoint trenches, depicted in Figure 4-16.

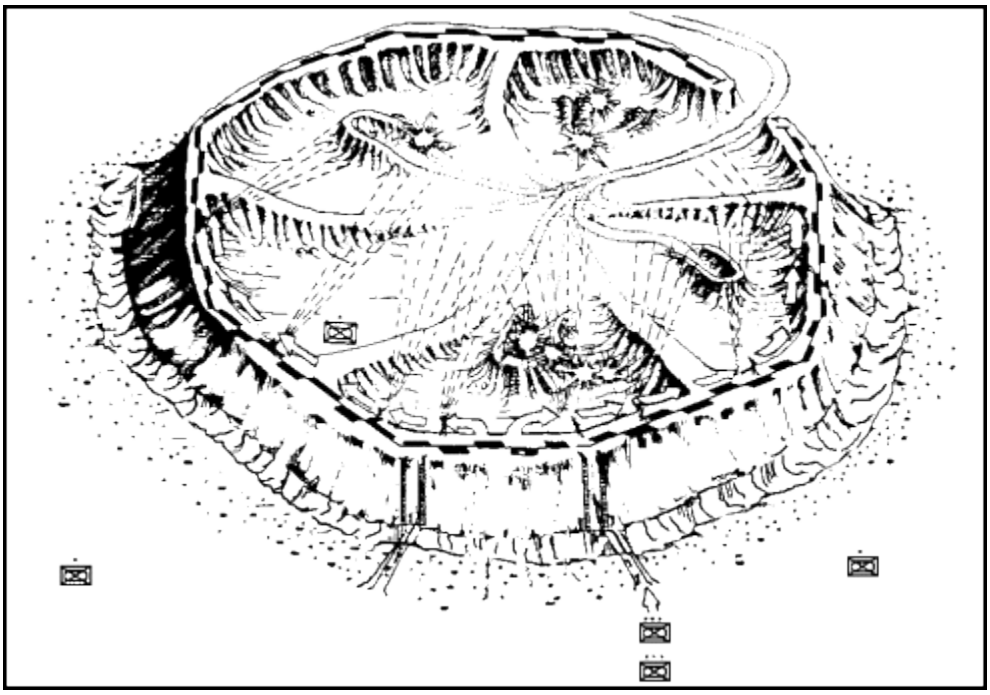

Figure 4-16. Attacking A Strongpoint— Phase II (Assault).

First, they set up blocking positions in the trenches and establish a base of fire. The primary task of the element providing the base of fire is to gain fire superiority over the enemy in the center of the strongpoint. The assault groups also try to suppress enemy activity around the entire strongpoint. Squads, working by buddy teams, begin the systematic process of clearing the trench line in both directions simultaneously. To avoid confusion, there should be a predetermined point on the trench line where the two clearing forces will meet. The clearing elements usually stay in the trenches. Their procedure is generally to fire down the trench line, throwing grenades until one goes in or very near the side trenches or weapons positions, whereupon one or two individuals assault with automatic weapons.

The clearing elements must contend with one-man holes, complete with overhead cover, recessed along the sides of the main trench. After a team takes one or two of these positions, call another team forward to pass through and take the lead. This leap frogging process continues until teams have cleared the trench. At times it may be expedient to move outside the trench line along the outside of the berm to flank a weapon position and come in on it from a different direction.

(3) Phase III (Mopping Up). After friendly elements take the trench line, teams move to eliminate any enemy elements of resistance in the center of the strongpoint. Figure 4-17 shows tanks and other vehicles located behind berms of earth. Also, command and control and supply elements may remain in trenches or bunkers. The teams sent in to mop up these elements generally move from one covered position to another under the covering fire of friendly forces now occupying the trenches. They make use of hand grenades or explosive charges to toss over the berms and into the trenches and bunkers. This mopping up and consolidation completes the attack on this type strongpoint.

g. Offensive Operations in Hot. Barren Mountains. Avenues of approach are normally few, with very limited lateral movement except by helicopter. Reconnaissance must be continuous using all available means, as enemy defensive positions will be difficult to find. Normally, helicopters emplace observation posts on high ground.

After making contact, airmobile infantry can outflank and envelope the enemy while you place suppressive fires and close air support on all suspected positions, especially on dominating ground. Engineers should be well forward, to assist in clearing obstacles. If airmobile infantry is unable to outflank the enemy, it will be necessary to launch a deliberate attack.

Frontal attacks in daylight, even with considerable supporting fires, have limited chance of success against a well emplaced enemy. Flank attacks on foot take a lot of time. The best opportunity is at night or in very poor-visibility, but progress of men on foot will be slow and you should limit objectives. The force should make every effort to secure ground higher than enemy positions to allow the attack to be downhill. It may be possible to infiltrate to a position behind the enemy, preferably using the most difficult and hence unlikely route. This is very slow but it normally has the advantage of surprise.

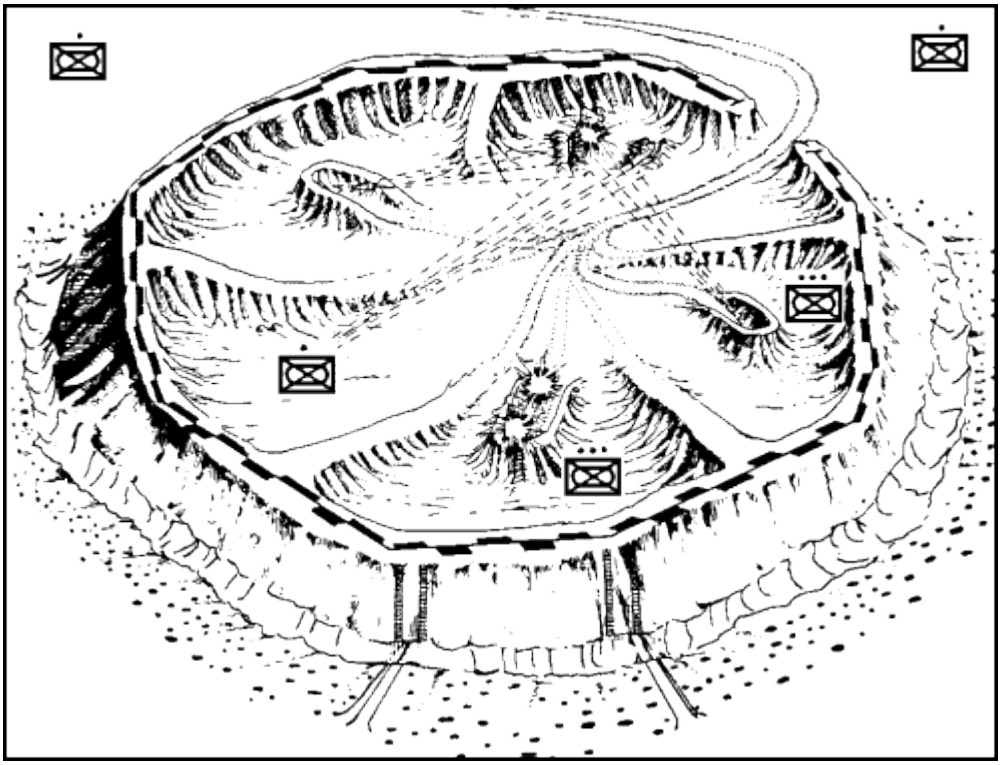

Figure 4-17. Attacking A Strongpoint— Phase III (Mopping Up).

The importance of dominating terrain, together with the enemy's knowledge that troops on the objective will be physically tired and dehydrated makes an immediate counterattack likely. The offense must bring forward supporting weapons at once, preferably by helicopter, and remove casualties by the same method.

Airmobile and attack helicopter units are well suited for pursuit operations. They can outflank retreating enemy, and set up positions overlooking likely withdrawal routes. You can emplace small engineer parties to block defiles and interdict trails.

Close air support and field artillery can reinforce airmobile and attack helicopter units and can counter efforts by enemy engineers to create obstacles.

PART B - DEFENSIVE OPERATIONS USED IN A DESERT ENVIRONMENT

1. Defensive Operations.

It is possible, but unlikely, that a U.S. force will fully deploy in a desert country before an enemy attacks. The more probable situation is a secure lodgement area with part of the force in position supporting an allied army, while the remainder is moving in by air and sea, as shown in Figure 4-18.

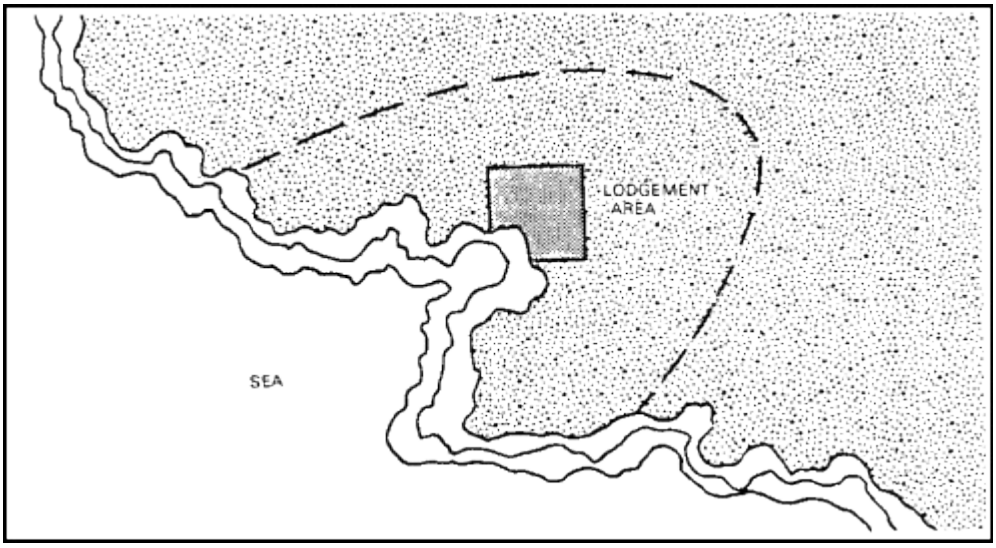

Figure 4-18. Deployment to a Secure Lodgement Area.

Strategically, the outnumbered allied force's initial mission will be to gain time until the whole force is present in the operational area. This will require a defensive posture initially, but a defense undertaken so aggressively as to convince the enemy that his offensive action is too costly in personnel and equipment to be worth maintaining. The enemy will be well aware that a U.S. force is arriving in the area, and will make every effort to conclude his operation successfully before the U.S. force fully prepares for battle. The first defensive battle will be critical to the outcome of the operation. Therefore, it is essential that the mission of destroying an enemy attack be fulfilled. Thus, in the first battles of this war, U.S. forces will defend outnumbered and they must win.

a. Terrain. The force may conduct defensive operations at any stage of the battle. Some part of the force may have to defend important terrain types like

(1) Man-made Features. These are features such as ports, key logistic installations, roads, railroads, water pumping stations, airfields, and wells.

(2) Natural Features. These are features such as mountain passes, or an occasional piece of dominating ground such as Mount Hermon on the border of Syria and Israel, or the Sollum escarpment near the sea between Libya and Egypt.

(3) Tactical Terrain. This feature need not necessarily be a major feature but one whose loss will inhibit the force in some manner. For example, the loss of terrain close to a lodgement area may hinder the planned rate of buildup.

Except for such cases, the holding of desert terrain normally makes little difference to the final outcome of battle. This does not mean that a commander has complete discretion to move his force wherever and whenever he wishes, as this will affect the dispositions of other U.S. forces or allies. It does mean that possession of terrain is less important and the destruction of enemy forces is the primary focus. It will be necessary to dominate certain terrain or retain freedom to maneuver in large areas of desert. Yet there is no more sense in permanently occupying such areas than there would be

permanently occupying a patch of sea. With equally equipped opposing forces, the critical factor in defense is the force ratios involved and the relative state of morale and training of the opposing forces.

b. Best Defense. A defense of aggressive maneuver at all levels is the best way to destroy large numbers of enemy without becoming destroyed in the process. If the defending force fails to remain mobile and active, the enemy will easily outflank it and strike directly at vital targets such as the lodgement area. It is almost certain that one flank or the other will be open as were the south flanks of the British and German forces in Egypt and Libya in 1940-43.

c. Security. Since it will not be possible to maintain an unbroken line between strategic obstacles, position air and ground security forces in width and depth to guard against an enemy trying to outflank the defender.

An unfavorable force ratio relies entirely on the defending force's ability to identify enemy avenues of approach early in the battle. This way, units may maneuver to locally change the force ratio in favor of the defender. If the force must defend on a broad front, you will need to define enemy avenues of approach and enemy strength on each avenue early. Then you can concentrate against the most dangerous threat while slowing or containing the enemy elsewhere in the battlefield.

It will be difficult for a brigade or battalion task force to determine where the enemy is going. So, a strong covering force is necessary to cause the enemy to concentrate for a main attack. If he hits the main battle area, advancing on a broad front, the advantage will be with the attacker.

d. Counterattack. Once you achieve a local force ratio of three or four to one, the defender can destroy the enemy force. The defense uses available obstacles, both natural and artificial to slow or contain the enemy or to isolate enemy targets and destroy his units one at a time. Forward units block and canalize the enemy into one or two avenues where you can engage him from the flank. A reserve can then counterattack by fire or fire and maneuver to destroy remaining enemy elements.

Mutual support is normally a factor of time rather than weapon range, due to the large areas that you have to cover. You may have to accept gaps in initial positions between and within task forces. Ideally you position units in such a manner that forces in at least two positions can engage an enemy maneuvering on any one of them. This greatly reduces any possibility of defeat in detail. Keep existing gaps under surveillance by some means. The defensive plan must include provisions for maneuvering to fire on any part of a gap before the enemy can move through it. Higher headquarters must define a unit's area of responsibility. You should be able to clearly identify it on the ground, which, due to the absence of significant terrain features, may require marking by artificial means.

e. Defensive Measures. Strongpoints are rare in desert warfare. Although, they may be necessary to defend an oasis, or, perhaps a mountain pass essential to the defender's scheme of maneuver. When it is necessary to deny terrain to an enemy force, it is far better to

- initiate the defense well forward of the terrain feature.
- conduct the defense in depth.

- destroy the enemy or force him to break off his attack before he reaches the critical feature.

When it is necessary to delay or withdraw, a desert offers many advantages to the defender. Long range fields of fire allow

- engagements at maximum effective range of direct-fire weapons systems.
- disengagement before the enemy can begin to close on the defender's position.

Dust clouds roused by a moving force make it necessary to disengage under cover of smoke or darkness. Units can use a sandstorm to advantage. Commanders can use field artillery, air force fighter bombers, and attack helicopters to allow a ground maneuver unit to disengage and move rapidly to the next position.

When it is necessary to trade space for time, often a counterattack to destroy enemy advance units will do more good than trying to defend longer from an intermediate position.

f. Plans. Commanders at all levels need to clearly understand the scheme of maneuver and concept of the operation, and what they are expected to do, especially should communications fail. Plans must include provisions for alternate means of communication. Units should clearly mark and reconnoiter their routes to the extent practical.

Due to the distances involved and constantly changing task organization and deployment, passage of lines will be more difficult to coordinate and control. You will have to pay extra attention to identification of vehicles, routes of passage, signals, and coordination of movements.

Deception should be a part of all desert retrograde operations. The object of deception is to conceal the fact that a retrograde operation is going to take place and that units are thinning out. You can use smoke, prepare dummy positions, transmit false radio messages, and even use dust clouds to deceive the enemy.

2. Fundamentals of Defense.

Doctrinal manuals appropriate to each level of command more fully describe the fundamentals of defense. Described below are the characteristics of defensive operations which are preparation, disruption, concentration, and flexibility.

a. Preparation. The below listed information is considered when preparing for defensive operations:

(1) The defender has significant advantages over the attacker. In most cases, he not only knows the ground better, but, having occupied it first, he has strengthened his positions. He is stationary and under cover in carefully selected positions, with prepared fires and obstacles.

(2) The attacker, however, has the initiative to choose the time and place of battle. The attacker tries to shatter the defense quickly and prevent its reconstitution by continuing the attack at a fast pace. The defender must slow the attacker's tempo, thereby providing time to isolate, fight, and destroy the attacker.

(3) Operational security is the defender's first requirement to defeat an attack. Units must maintain operational security, avoid patterns, and practice deception to hide the defender's disposition. Enemy reconnaissance efforts and probing attacks must be defeated without disclosing the scheme of defense. The reconnaissance battle is normally a prelude to the larger battle. The winner of the reconnaissance battle is usually the winner of the final battle.

(4) An enemy attack is preceded and accompanied by massed supporting fires. To survive, units must use defilade, reverse slope, and hide positions. Use supporting and suppressive fires and avoid easily targeted locations. The defender must use all available time to prepare fighting positions and obstacles, to rehearse counterattacks, and to plan supporting fires and combat service support in detail.

b. Disruption. An attacker's strength comes from momentum, mass, and mutual support of maneuver and combat support elements. The defender must slow or fix the attack, disrupt the attacker's mass, and break up the mutual support between the attacker's combat and combat support elements. This results in a piecemeal attack that can be defeated in detail. A general aim is to force the attacker to fight a nonlinear battle to make the attacker fight in more than one direction. This makes it more difficult for him to coordinate and concentrate forces and fires, and to isolate and overwhelm the defender. It also makes the securing of his flanks, combat support, combat service support, and command and control elements more difficult.

c. Concentration. To gain local superiority in one area, the defender is often forced to economize and accept risks elsewhere. Reconnaissance and security forces enable him to "see" the battlefield, and thereby reduce risk. The defender should be able to rapidly concentrate forces, thereby massing combat power to defeat an attacking force, then disperse and be prepared to concentrate again. The main effort is assigned to one subordinate unit. All other elements and assets support and sustain this effort. The commander may shift his focus by designating a new unit to be the main effort if other units encounter unexpected difficulties or achieve success.

d. Flexibility. Commanders designate reserves and deploy forces and logistic resources in depth to ensure continuous operations and to provide options for the defender if forward positions are penetrated.

(1) Contingency planning permits rapid action. Understanding the commander's intent and contingency plans allows subordinate commanders to rapidly exploit enemy weaknesses.

(2) Flexibility also requires that the commander "see the battlefield" to detect the enemy's scheme of maneuver in time to direct fires and maneuver against it. IPB determines likely enemy actions, while security elements verify which actions are actually taking place. The commander does not limit his intelligence gathering efforts only to the forces in contact, but also concentrates on formations arrayed in depth. The enemy may attempt to bypass areas where the defense is strong. Hence, the defending commander ensures that he is able to detect and react to enemy movement along all

possible avenues of approach throughout the course of the battle. The defender must never allow the attacker to gain tactical surprise.

3. Environmental Considerations.

In the desert, you must modify techniques of defense described in How-to-Fight manuals applicable to each level of command. Do this according to the fundamentals described in the preceding paragraph, and the mission, and environmental considerations described below.

a. Observation. The enemy will try to attack with the sun low and behind him so as to dazzle the defender. The defender's observers must be as high as possible above the desert floor in order to see the advancing enemy as soon as possible. Figure 4-19 illustrates this.

You can detect active light sources from great distances, especially during nights with low ambient light. You must maintain positive control of active sources until you join the battle. Even then, the force equipped with passive devices will have the advantage over the force which is not.

Heat from combat vehicles can give an enemy using thermal imagery devices a complete picture of the defensive scheme. So, combat vehicles should not prematurely occupy battle positions at night.

b. Sandstorms. The enemy may use sandstorms to hide an offensive operation, especially if the sandstorm is blowing away from him. When this is the case, units should occupy battle positions immediately before the storm arrives and remain there until it ends, ready to fire and maneuver against the attacker following the storm. If vehicle patrolling is possible, a scout platoon or similar unit should cover all gaps, preferably moving in pairs, and on straight lines in view of navigational difficulties.

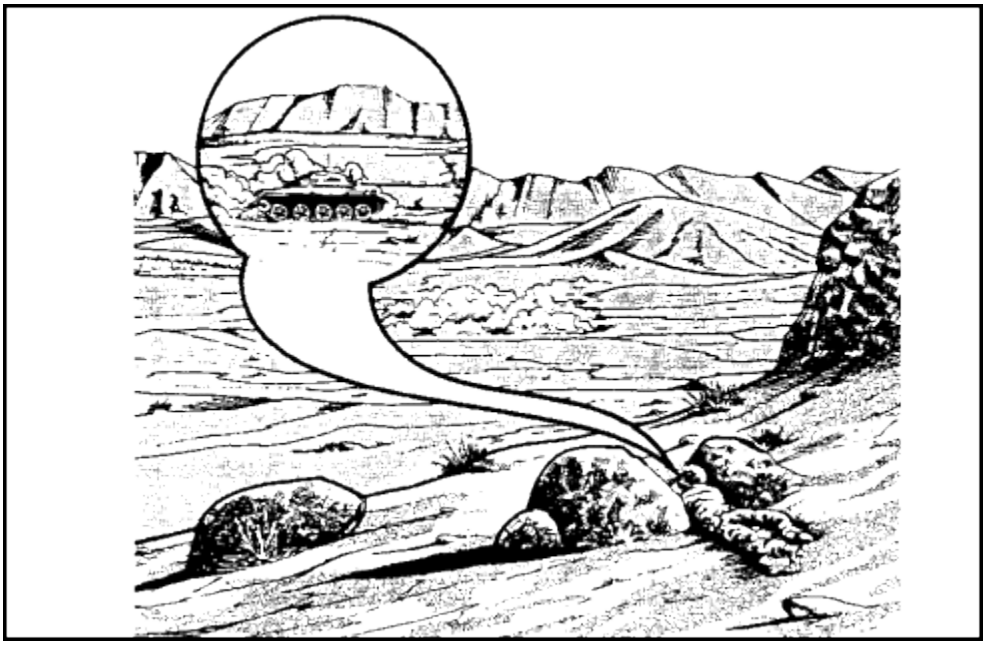

Figure 4-19. Observe from Height.

c. Terrain. From the point of view of a defending brigade or battalion task force commander, avenues of approach will often seem unlimited. You must maximize long-range observation and

employ scouts well forward to offset this problem. Extensively use radars to provide early warning. Artificial obstacles can help to limit avenues of approach, but as previously mentioned, they must be large to have any effect. It is necessary to identify the enemy's main effort early in order to move to concentrate.

Lack of concealment, especially from the air, prohibits units from occupying firing positions until just before engaging the enemy. Combat vehicles must displace immediately after engagement or risk destruction. Because of frequent displacement, reconnoiter routes between battle positions and mark them when possible, without revealing the scheme of defense. You must frequently use smoke to conceal movement.

Commanders must employ mech infantry in the way that they can best contribute to the fight. Deploy them either mounted or dismounted, depending upon the mission and/or terrain. For example, a tank-heavy company team may have the mission to engage a threat mechanized force at long range. The mechanized infantry cannot contribute to the long-range fight. Consequently, they may well remain mounted in a well-concealed hiding position. However, in certain locales, desert terrain is also hilly, and sometimes broken up. Therefore, they can effectively use their shorter range weapons.

d. Fires. As previously described, the desert offers excellent fields of fire. Place tanks and heavy antitank weapons in positions that will take advantage of their long range and accuracy. Firing accurately and first is most important in desert operations. It is easy to become disoriented, so it is often necessary to mark sectors of fire on the ground with poles, or rocks if available. Use indirect fires to slow the enemy advance, to suppress enemy weapons and observers, and to conceal movement between positions with smoke.

Long-range engagements with tanks and ATGM'S characterize defensive operations in deserts are:

4. Defense Example.

Figure 4-20 shows one way in which a division and a brigade may defend in the desert. Units depicted here are defending on almost featureless terrain against a larger enemy force. The units alter defensive operations to fit the terrain as it becomes more broken and avenues of approach become more easily identified. It is important to remember that in the desert, offensive maneuver may be the best defense.

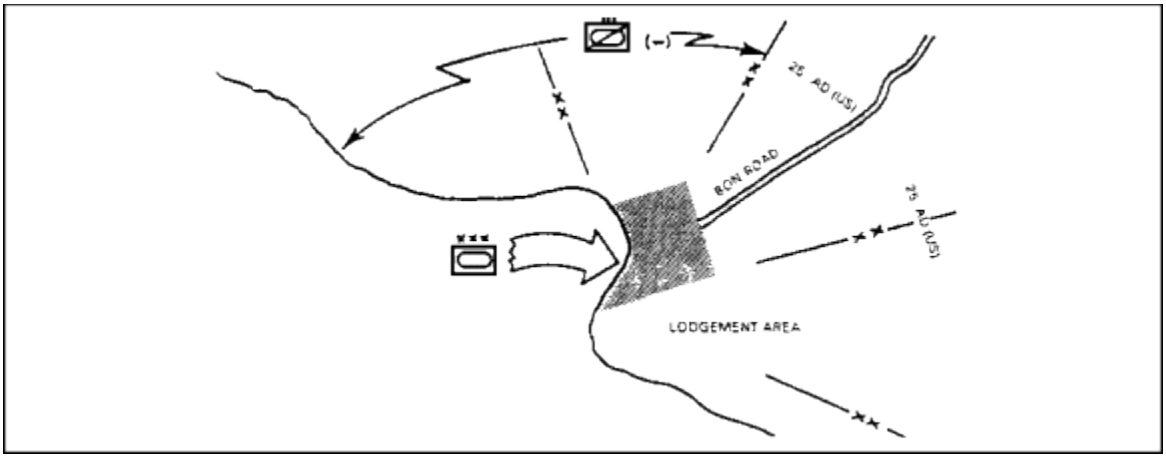

Figure 4-20. Security for Lodgement Area.

5. Defensive Operations in Hot, Barren Mountains.

A defense from a series of strongpoints is normal in hot mountains, due to the need to hold dominating terrain and due to restrictions on ground mobility. Due to the amount of rock in the soil, it takes more time to prepare positions, and normally requires engineer support.

You need to hold terrain-dominating avenues of approach. You must either hold or deny the enemy by fire any terrain that dominates a friendly position. You may need to stock several days' supplies, especially water, ammunition, and medical equipment in a position in case helicopters or supply vehicles are unable to reach it.

When using a covering force, organize it around cavalry reinforced with attack helicopters, supported by field and air defense artillery. Airmobile infantry operates on ridge lines. If the enemy closes on a battle position, it is difficult to extract airmobile infantry. Therefore, you should have sheltered landing sites nearby. In any event, you must cover extractions by air or ground suppressive fires. Use stay-behind observers to call down field artillery fires on targets of opportunity or just simply to report enemy activity. When tanks are a threat and terrain is suitable, reinforce the covering force with tank-heavy units and antitank weapons systems.

Combat in the main battle area is usually a series of isolated actions fought by strongpoints on ridgelines and in valleys. Use patrols extensively to harass the enemy and prevent infiltration. You must cover all possible routes. If the enemy attempts to outflank the friendly force, you must block him by attack helicopters, if available, or airmobile infantry.

Keep reserves centrally located and deployed by air to block or counterattack. If this is not possible, reserves may have to be split up and placed behind key terrain where they are available for immediate foot counterattack.

If retrograde operations are necessary, mountainous terrain is as good a place to conduct them as anywhere. You need more time to reconnoiter and prepare rearward positions, and you should prestock them as much as possible. Unlike the desert floor where movement between positions is likely to cover great distances, movement in these conditions is usually from ridge to ridge. You must cover routes with flank guards, especially at defiles or other critical points, as the enemy will attempt to block them or cut off rear guards.

LESSON 4
PRACTICE EXERCISE

Instructions The following items will test your understanding of the material covered in this lesson. There is only one correct answer for each item. When you have completed the exercise, check your answers with the answer key that follows. If you answer any item incorrectly, review that part of the lesson which contains the portion involved.

Situation: You have deployed to a desert area of North Africa. It is vital that you know how to identify and select the fundamentals of attacks and defenses used in desert operations.

1. Your combat service support finds existing roads unusable due to refugees fleeing from a nearby city. Therefore,

   - ○ A. you keep your combat service support well to the rear because a maneuvering force must push out actively and aggressively.
   - ○ B. your offensive operation must be slow and measured with non-violent maneuver to avoid endangering refugees.
   - ○ C. you can safely disregard negative reports of enemy sightings.
   - ○ D. you send out extensive reconnaissance patrols on main highways as a deceptive measure.

2. Desert warfare means maneuvering over large distances. Your offense is experiencing more casualties from accidents and friendly fire. A correct course of action is to

   - ○ A. conduct movement at night or in conditions of limited visibility whenever possible to avoid detection.
   - ○ B. disregard and bypass some enemy long-range antitank capability.
   - ○ C.quickly maneuver around obstacles to avoid deploying breaching equipment.
   - ○ D. never tip off the enemy by reconnoitering your leaders and marking routes.

3. Which significant factor must you take into consideration while on the offense in the desert?

   - ○ A. If a sandstorm blowing from the enemy, catches one of your advancing units, it is best to press on through the crest of the storm.
   - ○ B. A moving force has more of an advantage in comparison with a stationary unit.
   - ○ C. In conditions of restricted trafficability you must conduct a frontal attack.
   - ○ D. When on the offensive, use every opportunity for resupply.

4. You reach a meeting engagement, at which point a commander must seize the initiative by

   - ○ A. cutting off further intelligence input activities for time to formulate plans.
   - ○ B. making a rapid estimate of the situation and issuing fragos.
   - ○ C. maintaining units in a disciplined march column.
   - ○ D. concentrating field artillery in formation for direct-fire shock effect.

5. You must come up with a plan of attack that takes full advantage of the mobility and speed of track vehicles in the desert. In outlining your plan to the commander, you point out one advantage.

   - ○ A. You organize your main attack to orient on the enemy's greatest vulnerability-his rear-area combat service support.
   - ○ B. The major threat to the success of your plan is if the enemy retrogrades so he can't be tied down and destroyed.
   - ○ C. You plan your attack on a wide front to increase your chances of punching through a weak point.
   - ○ D. You hold your reserves behind a major terrain obstacle as a deception tactic.

6. Your task force proceeds over a large expanse of barren terrain. Up ahead is a mountain range where airborne observers have reported a network of strong points. You successfully attack using which fundamental of desert warfare?

   - ○ A. The synchronized employment of combined arms.
   - ○ B. The stealthy breaching by engineer teams.
   - ○ C. The mass deployment of flanking armored vehicles making maximum use of shock effect.
   - ○ D. The sunrise frontal hasty attack.

7. It may be some time before you are ready to take on the strongpoints. Therefore, you must defend a lodgement area awaiting reinforcements. Since you are outnumbered, your best defense is to

   - ○ A. stand your ground and take advantage of cover and concealment.
   - ○ B. identify enemy avenues of approach early in the battle.
   - ○ C. maintain a narrow but solid perimeter line.
   - ○ D. defend an intermediate position and delay expending your resources as long as possible.

8. You maximize your defense because you understand the enemy and see the battlefield. A key factor you exploit is

   - ○ A. procedures for counterbattery fire because of enemy weaknesses like towed field artillery or tanks having to expose hulls for firing.
   - ○ B. quick reaction to every enemy movement based on his long-term objectives and supported by scout security.
   - ○ C. maximum firepower in all directions over 24 hours to take advantage of the enemy's general poor health and boosted rate of accidental casualties through sleep deprivation.
   - ○ D. engineer effort disseminated throughout every level of defense for as many tangle-foot booby traps as possible all around the perimeter.

9. Your knowledge of desert warfare leads you to conclude the enemy attack

   - ○ A. will attempt to dazzle the defender with the sun low and behind him.
   - ○ B. will be delayed as long as you keep the lodgement area well-maintained with active light sources.
   - ○ C. will be met most effectively by pre-positioning combat vehicles early in any anticipated movement to contact.
   - ○ D. is best defeated by deploying mechanized infantry at limited long-range avenues of approach effectively peppered with obstacles and indirect fire.

PRACTICE EXERCISE

ANSWER KEY AND FEEDBACK

Situation: You have deployed to a desert area of North Africa. It is vital that you know how to identify and select the fundamentals of attacks and defenses used in desert operations.

1. Your combat service support finds existing roads unusable due to refugees fleeing from a nearby city. Therefore,
   A. you keep your combat service support well to the rear because a maneuvering force must push out actively and aggressively.
   B. your offensive operation must be slow and measured with non-violent maneuver to avoid endangering refugees.
   C. you can safely disregard negative reports of enemy sightings.
   D. you send out extensive reconnaissance patrols on main highways as a deceptive measure.

      Extensive reconnaissance patrols in an area alerts the enemy to pending operations, and thus may be a deceptive measure. You must maintain a responsive combat service support without lines of communication too long. You can try to avoid endangering refugees, but a successful offense depends on rapid, responsive and violent maneuver. Negative reports may be just as important as enemy sightings in the desert.

2. Desert warfare means maneuvering over large distances. Your offense is experiencing more casualties from accidents and friendly fire. A correct course of action is to
   A. conduct movement at night or in conditions of limited visibility whenever possible to avoid detection.

      All units must be equipped, trained, and experienced such that they consider it more normal to move at night or in conditions of limited visibility. You should not disregard any target that has a long-range antitank capability. If you maneuver quickly around obstacles, you may find you are lead by the enemy into a fire pocket. Units are liable to lose direction unless routes are reconnoitered and even marked of with such insignificant objects as small rock piles.

   B. disregard and bypass some enemy long-range antitank capability.
   C. quickly maneuver around obstacles to avoid deploying breaching equipment.
   D. never tip off the enemy by reconnoitering your leaders and marking routes.

3. Which significant factor must you take into consideration while on the offense in the desert?
   A. If a sandstorm blowing from the enemy, catches one of your advancing units, it is best to press on through the crest of the storm.
   B. A moving force has more of an advantage in comparison with a stationary unit.
   C. In conditions of restricted trafficability you mustconduct a frontal attack.
   D. When on the offensive, use every opportunity for resupply.

      Because of considerable use of ammunition and POL, offensive operations should use every opportunity for resupply. If caught in a sandstorm blowing against your direction, it is best to halt until the storm abates. A moving force is more at a disadvantage because of dust clouds and the lack of concealment. Where there is restricted trafficability, you should avoid frontal attacks.

4. You reach a meeting engagement, at which point a commander must seize the initiative by
   A. cutting off further intelligence input activities for time to formulate plans.
   B. making a rapid estimate of the situation and issuing fragos.

      You can retain the initiative by making rapid estimates of the situation and issuing fragmentary orders ("fragos"). You also need to commit units from march column. In a meeting engagement, you have inadequate intelligence of the enemy force, and you have limited time to develop the situation. You want to intersperse your field artillery throughout the formation for immediately available indirect fires.

   C. maintaining units in a disciplined march column.
   D. concentrating field artillery in formation for direct-fire shock effect.
5. You must come up with a plan of attack that takes full advantage of the mobility and speed of track vehicles in the desert. In outlining your plan to the commander, you point out one advantage.
   A. You organize your main attack to orient on the enemy's greatest vulnerability his rear-area combat service support.

      You want to maintain the momentum of the attack oriented on the enemy's greatest vulnerability his combat service support system. Your major threat is a counterattack. An advantage of your plan is to attack on a narrow front to increase chances of favorable force ratios. You want mutual support of attacks and your reserves readily available to support the main effort.

   B. The major threat to the success of your plan is if the enemy retrogrades so he can't be tied down and destroyed.
   C. You plan your attack on a wide front to increase your chances of punching through a weak point.
   D. You hold your reserves behind a major terrain obstacle as a deception tactic.

6. Your task force proceeds over a large expanse of barren terrain. Up ahead is a mountain range where airborne observers have reported a network of strong points. You successfully attack using which fundamental of desert warfare?
   A. The synchronized employment of combined arms.
   B. The stealthy breaching by engineer teams.

      When breaching a strongpoint, the initial phase is characterized by stealth, and uses breaching teams to assist assaulting forces marking lanes, clearing minefields, setting up ladders or bridges. You must effectively employ your combined arms teams not all at once, but so that one element is always in position to cover by fire while another element is moving to a new position. It may not be practicable to assault certain strong points with armored vehicles. Daylight frontal attacks have limited success against a well-emplaced enemy, even with considerable supporting fires.

   C. The mass deployment of flanking armored vehicles making maximum use of shock effect.
   D. The sunrise frontal hasty attack.
7. It may be some time before you are ready to take on the strongpoints. Therefore, you must defend a lodgement area awaiting reinforcements. Since you are outnumbered, your best defense is to
   A. stand your ground and take advantage of cover and concealment.
   B. identify enemy avenues of approach early in the battle.

      You also must consider your unfavorable force ratio and identify the enemy avenues of approach early. Your best defense is to remain mobile and active with aggressive maneuver so you are not outflanked by the enemy. It is better to conduct the defense in depth. Instead of trying to defend longer from intermediate units, it is often better to counterattack to destroy enemy advance units.

   C. maintain a narrow but solid perimeter line.
   D. defend an intermediate position and delay expending your resources as long as possible.
8. You maximize your defense because you understand the enemy and see the battlefield. A key factor you exploit is
   A. procedures for counterbattery fire because of enemy weaknesses like towed field artillery or tanks having to expose hulls for firing.

      You want to prepare to place counterbattery fire because the enemy has weaknesses such as not being able to pull back after firing because of cumbersome towed artillery or tanks with limited main-gun depression. The commander can do nothing more than react to enemy initiatives. He can't maneuver to destroy him until he establishes intelligence from scouts about the enemy's short-term objectives, avenues of approach or reality of movements. It is impossible to have firepower in all directions. You must be able to maneuver to threatened areas before the enemy. Rather than numerous small obstacles, your engineer effort should be expended on

one or two main obstacles that can divide or divert an attack in desert terrain.

B. quick reaction to every enemy movement based on his long-term objectives and supported by scout security.

C. maximum firepower in all directions over 24 hours to take advantage of the enemy's general poor health and boosted rate of accidental casualties through sleep deprivation.

D. engineer effort disseminated throughout every level of defense for as many tangle-foot booby traps as possible all around the perimeter.

9. Your knowledge of desert warfare leads you to conclude the enemy attack

A. will attempt to dazzle the defender with the sun low and behind him.

You must keep your observers high above the desert floor when the sun is low and in front of you when it is timely for enemy attack. Although lodgement areas may be well lighted, this can be seen for miles over the horizon, and should be controlled until you join the battle. If you preposition combat vehicles early, their heat can provide thermal-images used by the enemy. Your avenues of approach in the desert are probably unlimited. Mechanized infantry cannot contribute to long-range fight. Artificial obstacles must be large to have effect.

B. will be delayed as long as you keep the lodgement area well-maintained with active light sources.

C. will be met most effectively by pre-positioning combat vehicles early in any anticipated movement to contact.

D. is best defeated by deploying mechanized infantry at limited long-range avenues of approach effectively peppered with obstacles and indirect fire.